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"THE ENGINEER," JUNE 29, 1928.

With METALLURGICAL SUPPLEMENT.

The Engineer.

Established 1856.

Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXLV.—No. 3781] LONDON: FRIDAY EVENING, JUNE 29, 1928 [PRICE { WITH SUPPLEMENT } ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

Department of Scientific AND INDUSTRIAL RESEARCH. TWO JUNIOR ASSISTANTS (ENGINEERS) are required at the Fuel Research Station, East Greenwich, S.E. 10. Candidates must have a good Honours Degree in Engineering or equivalent qualification, together with some practical or research experience.

Scale of salary £175-15-£235 per annum, plus Civil Service bonus; initial pay approximately £265. Superannuation provision will be made under the Federated Superannuation System for Universities. Application forms to be obtained from the SECRETARY, Department of Scientific and Industrial Research, 16, Old Queen-street, S.W. 1, to whom they should be returned not later than Monday, July 9th. 8862

Department of Scientific AND INDUSTRIAL RESEARCH. JUNIOR ASSISTANTS are REQUIRED at the NATIONAL PHYSICAL LABORATORY. Candidates must have a good Honours Degree or equivalent qualification in Engineering or Naval Architecture, and preferably some research or practical experience.

Scale of salary £175-15-£235 per annum plus Civil Service bonus; initial pay approximately £265. Superannuation provision will be made under the Federated Superannuation System for Universities.—Application must be made on a form to be obtained from the Laboratory, and must be received by the DIRECTOR, National Physical Laboratory, Teddington, not later than July 14th.
E.1024/2. 8827

District Engineers Required by the GOVERNMENT of CEYLON for the Railway Department for three years' service, with possible extension. Salary £500, rising to £960 a year.; £800 may be allowed in the fourth year of service or on completion of 30 years of age, whichever is earlier, provided the applicant is fully qualified. Free passages are provided, and if married for wife and children also, not exceeding four persons beside the person selected. A rent allowance is paid if no quarters are available. Candidates should be Corporate Members of the Institution of Civil Engineers or hold an Engineering Degree or Diploma recognised as granting exemption from Sections A and B of the A.M.I.C.E. Examination, and should, in addition, have had at least five years' suitable experience on railways, partly on construction and partly on maintenance of an open line. Must be capable of taking charge of a district of about 200 miles, carrying on any or all the duties of the District Engineer if and as required, or of taking charge as Resident Engineer of large betterment works. They should be capable of designing all details in connection with such works as may be necessary during the execution of the work.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/414. 8907

Draughtsmen Required, R.A.S.C. Training College, Aldershot; one with good practical and theoretical training automobile engineering and experience preparing diagrams in perspective for instructional handbooks and lectures. One for junior post. Salaries, including bonus, 68s. 10d. to 82s. a week. Preference given to ex-Service men.—Write M.T., CHIEF INSTRUCTOR, above address, giving age, qualifications, and copies testimonials. 8863

Maintenance Engineer REQUIRED by the GOVERNMENT of the GOLD COAST for Waterworks, for two tours of 12 to 18 months' service. Salary £480 a year for three years and then £510, rising to £920 a year by annual increments. Outfit allowance of £60 on first appointment; free quarters and passages; liberal leave on full salary. Candidates, 25-35, must be Students or Associate Members of the Institution of Civil Engineers, or hold the Testamur of the Institution of Municipal and County Engineers, have been trained in the office of a Waterworks Engineer and/or have been employed in the construction and maintenance of waterworks and be competent to design and supervise the construction of reinforced concrete storage tanks.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/716. 8906

Ministry of Transport. ROADS DEPARTMENT. APPLICATIONS are INVITED for APPOINTMENT as TEMPORARY ASSISTANT ENGINEER for Road Survey and Inspection Work in the London traffic area. The salary ranges between £300 and £350 per annum inclusive.

Candidates should be practical and experienced men with a knowledge of local administration and of modern road and bridge construction. Knowledge of railway location and construction would be an advantage. Preference will be given to men who have served in H.M. Forces.

Application forms can be obtained from the ESTABLISHMENT OFFICER, Ministry of Transport, Whitehall-gardens, S.W. 1, to whom they should be returned not later than 9th July. 8861

The Government of India REQUIRE an ASSISTANT FOREMAN for the Acid Section, Cordite Factory, Aruvankadu.

APPOINTMENT 102.—Candidates should have had considerable experience in an Acid Works and must have had experience of Sulphuric Acid Manufacture (chamber process). Preference will be given to a candidate who also possesses a knowledge of any of the following processes:—(A) Nitric Acid Manufacture (from Nitrate of Soda); (B) Concentration of Sulphuric Acid (Kessler process); (C) Treatment of Residual Acids from Guncotton and Nitroglycerine Manufacture; (D) knowledge of Mixing Acids for Manufacture of Guncotton and Nitroglycerine. Applicants should be between 25-35 years and capable of controlling labour.

TERMS.—Salary Rs. 450-15-510 per mensem, with prospects of further increases. Agreement for five years in first instance. Free second-class passage to India and return passage on satisfactory termination of services. Free quarters. Medical examination.

Further particulars and forms of application may be obtained on request by postcard (quoting Appointment 102) from the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 21st July, 1928. 8867

The Engineer

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PUBLIC NOTICES

Civil Service Commission. FORTHCOMING EXAMINATION, NON-ESTABLISHED DRAUGHTSMAN in the Ministry of Agriculture and Fisheries (18-25, with extension in certain cases).

Regulations and particulars are obtainable from the SECRETARY, Civil Service Commission, Burlington-gardens, London, W. 1, together with the form on which application must be made. The latest date for the receipt of application forms is 26th July. 8823

The Worshipful Company of ARMOURERS AND BRASIERS IN THE CITY OF LONDON.

The Company of Armourers and Brasiers are offering a FELLOWSHIP of £300 per annum, tenable from the 1st of October next, for Research Work in connection with Aeronautics.

Full particulars and forms of application can be obtained from

THE CLERK,
The Company of Armourers and Brasiers,
81, Coleman-street, London, E.C. 2,

with whom applications must be lodged before the 28th July, 1928. 8917

Hull Education Committee. MUNICIPAL TECHNICAL COLLEGE.
PRINCIPAL: E. P. BATES, M.A.

WANTED, to commence 3rd September, a HEAD of the ENGINEERING DEPARTMENT.

Commencing salary £500 per annum, rising by annual increments of £20 to a maximum of £600 per annum. Consultative work may be undertaken with the approval of this Committee.

Forms of application and further particulars may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope, and must be returned so as to reach these offices not later than 11th July.

R. C. MOORE,
Director of Education.

Education Offices,
Guildhall, Hull,
23rd June, 1928. 8859

PUBLIC NOTICES

The University of Sheffield. SESSION 1928-29.
Vice-Chancellor: SIR HENRY HADOW, C.B.E., D.Mus., LL.D.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING. METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the above Departments extend over three or four years and prepare students to become specialists in one or other of these branches of Applied Science.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part-time Courses are arranged for students who desire to take special portions of any of the regular Courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering, and in Glass Technology, arrangements are made to enable students who come to the University from works or collieries to take six months' Courses of study at the University and six months' practice at the works or colliery each year for a period of four years. During the first year such students should spend three terms at the University.

RESEARCH Fellowships and Scholarships are awarded annually.

The LECTURE COURSES commence OCTOBER 3rd, 1928.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 25th, 1928.

Particulars of Entrance and Research Scholarships available will be sent on application.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to

W. M. GIBBONS,
Registrar.
8733

University of London. The Senate invite APPLICATIONS for the MAYBURY (part-time) CHAIR of HIGHWAY ENGINEERING, tenable at the City and Guilds College. Salary £750 a year.—Applications (12 copies) must be received not later than first post on 4th September, 1928, by the ACADEMIC REGISTRAR, University of London, South Kensington, London, S.W. 7, from whom further particulars may be obtained. 8826

PUBLIC NOTICES

Armstrong College, NEWCASTLE-UPON-TYNE.
(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.SC. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.

The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.

Full particulars of the Courses may be had on application to

THE REGISTRAR,
Armstrong College,
7059 Newcastle-upon-Tyne.

University College of South WALES AND MONMOUTHSHIRE.
COLEG PRIFATHROFAOL DEHEUDIR CYMRU A MYNWY.

The Council of the College invites APPLICATIONS for the APPOINTMENT of ASSISTANT LECTURER and DEMONSTRATOR in ENGINEERING. The commencing salary will be £300 per annum.

Further particulars may be obtained from the undersigned, by whom three copies of application and testimonials must be received on or before July 16th, 1928.

D. J. A. BROWN,
Registrar.
University College, Cardiff,
June 20th, 1928. 8868

University of London. UNIVERSITY COLLEGE.
APPOINTMENT OF LECTURER IN CHEMICAL ENGINEERING.

The University College Committee will shortly APPOINT a LECTURER in the Department of Chemical Engineering, which is under the direction of Professor W. E. Gibbs. The Lecturer should be a Graduate in Engineering of a British University and have had some training in Chemistry. Industrial experience is also desirable. Salary £350 to £450, according to previous experience.

Particulars may be obtained from C. O. G. DOUIE, University College, London (Gower-street, W.C. 1). 8911

Bombay, Baroda and Central INDIA RAILWAY COMPANY.

The Directors are prepared to receive up to Noon on Friday, 20th July, TENDERS for the SUPPLY of:—
1. GIRDER BRIDGES (100ft. spans);
and up to Noon on Friday, 13th July, TENDERS for the SUPPLY of:—
2. AXLES for CARRIAGES and WAGONS.
3. TYRES for CARRIAGES and WAGONS.

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of 20s. each for No. 1 and 10s. each for Nos. 2 and 3 (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG,
Secretary.

Offices: The White Mansion,
91, Petty France, Westminster, S.W. 1,
27th June, 1928. 8910

DRY DOCKING, &c., OF R.A.S. "RED CROSS."

The Metropolitan Asylums BOARD invite TENDERS for DRY DOCKING and REPAIRING the HULL and FITTINGS of the River Ambulance Steamer "Red Cross."

Specification, conditions of contract and form of Tender may be obtained at the office of the Board, Victoria Embankment, E.C. 4.

Tenders, addressed as noted on the form of Tender, must be delivered at the office of the Board not later than 10 a.m. on Wednesday, 11th July, 1928.

ALLAN POWELL,
Clerk to the Board.
8920

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PUBLIC NOTICES

City of Leeds.

ELECTRICITY DEPARTMENT.
STRUCTURAL STEEL WORK.

The Leeds City Council are prepared to receive TENDERS for the SUPPLY and ERECTION of approximately 1300 TONS of STRUCTURAL STEEL WORK, to be used in the construction of an Electricity Generating Station at Kirkstall, Leeds.

Copies of the general conditions, specification, bill of quantities and form of Tender may be obtained from Mr. C. Nelson Hefford, Manager of the Department, 1, Whitehall-road, Leeds, on or after Wednesday, 4th July, 1928, on payment of a deposit of Two Guineas, which will be refunded on receipt of a bona fide Tender. Cheques to be made payable to "The Leeds Corporation or Order" and crossed "// & Co."

Tenders must be in the form attached to the specification and must be delivered to me at the Town Clerk's Office, Committee Department, 26, Great George-street, Leeds, not later than Eleven o'clock in the forenoon of Saturday, 14th July, 1928, in sealed envelopes endorsed "Electricity—Tender for Structural Steel Work."

The Corporation do not bind themselves to accept the lowest or any of the Tenders sent in.

THOS. THORNTON,
Town Clerk.

Leeds, 26th June, 1928. 8886

Government of Northern

IRELAND.
NOTICE TO SHIPBUILDING CONTRACTORS.

The Ministry of Finance invites TENDERS for the CONSTRUCTION and FREE DELIVERY of a DREDGER and PLANT as detailed below :—

1. ONE TUG of the sea-going type, built to all Board of Trade requirements, to be fitted with Internal Combustion Engines either of the Diesel or Semi-Diesel type, and to be equipped with sufficient power to be able to tow the two Hopper Barges, Dredger, and Rock Drilling Barge specified in Clauses 2, 3 and 4 a short distance and in reasonable weather, draught not to exceed 5ft. 6in. aft.

2. TWO Steel-built TOWING HOPPER BARGES, each capable of carrying 200 tons deadweight, or with a hopper capacity of approximately 130 c. yds., draught not to exceed 5ft. 6in. loaded, and the extreme beam not to exceed 19ft. These vessels are to be of the flat-bottom type, suitable for lying aground, and capable of discharging their cargoes at sea.

3. ONE Steel-built GRAB DREDGER, non-propelled, beam not to exceed 19ft. and draught 4ft., to be fitted with a suitable dredging crane, capable of working 1 c. yd. water measurement dredging bucket with a working radius of 25ft., arranged that it can be worked either over the stern or either side of the vessel, with a dredging depth up to 40ft., to be quite seaworthy, and to be of the flat-bottom type, whereby the craft can lie safely aground.

4. ONE Steel-built ROCK DRILLING BARGE of the flat-bottom type, suitable for lying aground, capable of working six jumper drills. The power for working these jumper drills to be of a suitable motor type of engine. The beam not to exceed 19ft. and draught not to exceed 2ft. 6in. fully loaded, complete ready for work, together with all the necessary hand manœuvring winches, &c. The drills to be of assorted lengths for a total drilling depth up to 30ft. for each drill.

5. GENERAL CONDITIONS.—All firms tendering should submit with their Tender a full specification of the tug, barges, grab dredger and rockbreaking plant which they propose to supply, giving leading dimensions, size of scantlings, thickness of plating, &c., and a list giving full particulars and make of the fittings included, together with drawings showing general craft arrangements and midship section.

6. DELIVERY.—Free delivery of the five craft to be made at the Port of Belfast, and firms tendering should state the time they require for such delivery. All the vessels supplied to be fitted with the latest Board of Trade life-saving apparatus, together with navigation lights, &c., as suitable and customary for dredging vessels of this description.

Each Tender shall contain separate prices for each unit detailed. The envelope containing the Tender is to be addressed to the Secretary, Ministry of Finance, 15, Donegall-square West, Belfast, and marked "Tender for Dredger and Plant." Tenders will be received up to but not later than 3 p.m. on the 20th day of July, 1928.

The Ministry is not bound to accept the lowest or any Tender. Preference will be given to firms on the King's National Roll.

The contractor whose Tender is accepted shall execute a deed of contract in the form to be prepared by the Ministry of Finance for Northern Ireland and agreed by the contractor.

R. E. THORNLEY,
Assistant Secretary.

Ministry of Finance,
15, Donegall-square West, Belfast,
20th June, 1928. 8870

The Madras and Southern

MAHRATTA RAILWAY COMPANY, Limited, invite TENDERS for :—

300 STEEL AXLES FOR CARRIAGES AND WAGONS.

Tenders are due in on Tuesday, 10th July, 1928, by 2 p.m.

Tender form obtainable at address below ; fee One Guinea, which is not returnable.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices :
25, Buckingham Palace-road,
Westminster, S.W. 1. 8891

Pontefract Corporation Water-

WORKS.
NEW PUMPING MAIN.

The Corporation of Pontefract invite TENDERS from competent contractors for PROVIDING and LAYING 2000 YARDS of 16in. CAST IRON PUMPING MAIN from the site of the new Waterworks at Ezgborough to the existing Roall Waterworks.

Copy of the specification and schedule of works may be obtained from the Consulting Engineer, Mr. F. Walter Hodson, M. Inst. C.E., M. Cons. E., of Bank Chambers, Loughborough, on deposit of cheque for £5 5s., which will be refunded on receipt of a bona fide Tender and the return of the documents. Copies of the drawings may also be seen at the office of Mr. W. H. Newton, A.M. Inst. C.E., Borough Engineer, Pontefract, and at the Roall Pumping Station.

Tenders are to be sent to the undersigned not later than first post 24th July, 1928.

F. M. FARMER,
Town Clerk.

Municipal Offices, Pontefract,
June, 1928. 8901

The South Indian Railway Com-

PANY, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. POINTS AND CROSSINGS.
2. BOGIE PETROL TANK WAGONS (M.G.).
3. STEEL CRANKED FISH-PLATES.
4. COMPRESSED AIR MAINS, &c.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Points and Crossings," or as the case may be, must be left with the undersigned not later than Twelve Noon on Friday, the 13th July, 1928, in respect of Specifications Nos. 1, 3 and 4, and not later than Twelve Noon on Friday, the 20th July, 1928, in respect of the Specification No. 2.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of £1 for each copy of Specification No. 1, and of 10s. for each copy of Specification No. 2, and of 2s. 6d. for each copy of Specifications Nos. 3 and 4.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, Westminster, S.W. 1,
27th June, 1928. 8918

PUBLIC NOTICES

State Electricity Commission

OF VICTORIA, AUSTRALIA,
22-32, William-street,
MELBOURNE,
AUSTRALIA.

TENDERS are HEREBY INVITED for the MANUFACTURE, TESTING, SUPPLY, DELIVERY and ERECTION COMPLETE for the Yallourn Power Scheme, of WATER-TUBE BOILERS with Auxiliary and Accessory Equipment, in accordance with Specification No. 28/37.

Copies of Tender form, specification, drawings, &c., will be available upon application to the Agent-General for Victoria, Victoria House, Melbourne-place, Strand, LONDON.

Charge £1 1s. for three copies of Tender form, conditions of tendering, specification, contract conditions and drawings complete. This charge is returnable under certain conditions as specified in the general conditions of tendering. Extra copies 10s. 6d. each, not returnable. A preliminary deposit of £100 shall be lodged with Tender.

Tenders on prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than 31st October, 1928.

The Commission does not bind itself to accept the lowest or any Tender.

R. LIDDELOW,
Secretary.

8825

The Abertillery and District

WATER BOARD.
SALE OF PLANT.

The above Board OFFER FOR SALE, a first-class ELECTRIC GENERATING PLANT, as under :—

No. 2 Ruston and Hornsby 230 B.H.P. TWIN-CYLINDER GAS ENGINES, with Producer Gas Plants complete.
No. 2 COMPOUND-WOUND GENERATORS, by Metropolitan-Vickers, 500-volt, 150-kW.
No. 1 Ruston and Hornsby STARTING COMPRESSOR.
No. 1 G.E.C. SWITCHBOARD.
No. 1 COOLING TOWER.

Also a smaller GENERATING PLANT, consisting of
No. 1 100 H.P. National GAS ENGINE and PRODUCER PLANT, with No. 1 Bruce Peebles 100-kW, 500-volt Dynamo.

Further particulars can be obtained from the Board's Engineer, Mr. J. Francis Jupp, M. Inst. C.E., Midland Bank Chambers, Newport, Mon. 8852

The Assam-Bengal Railway

COMPANY, Limited, is prepared to receive TENDERS for :—

15 BOGIE PETROL TANK WAGONS.

Specifications and Tender forms may be obtained at the offices of the Company, Bishopsgate House, 80, Bishopsgate, E.C. 2. A fee of £1 1s. is charged, which cannot under any circumstances be returned.

Drawings may be had at the cost of the tenderer by application to Messrs. Hodges Bennett and Co., Ltd., 78, Queen Victoria-street, E.C. 4.

Tenders must be delivered at the Company's offices not later than Noon on Wednesday, the 18th July, 1928.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
THOS. C. BRETT,
Secretary.

25th June, 1928. 8885

Appointment of City Engineer.

APPLICATIONS are INVITED by the Mayor and Town Council of Georgetown for the APPOINTMENT of CITY ENGINEER of Georgetown, a city with a population of 55,000 and area of approximately 2½ square miles.

Candidates must be Chartered Civil Engineers or Members or Associated Members of the Institution of Civil Engineers, or have obtained the Testamur of the Institution of Municipal and County Engineers and have wide experience in the designing and carrying out of works, especially waterworks, sewerage and sewage disposal (pumps being operated by electricity), surface drainage and construction of streets ; experience in reinforced concrete construction is desirable.

Special consideration will be given to applications of candidates with an Honours Degree in Engineering.

No candidate will be considered unless he is over 30 and under 45 years of age.

The salary offered by the Council is £1000 per annum, with annual increments after the second year of £50 per annum until the salary reaches £1200 per annum, and a motor car allowance of £100 a year.

Term of engagement 4 years, with re-engagement for such period and on such terms as may be mutually agreed.

The appointment and dismissal of City Engineer are according to law made by the Council subject to the concurrence of the Governor-in-Council of the Colony.

The successful candidate will be required to devote the whole of his time to the duties of the office and not to engage in private practice or any other duty or employment.

The appointee will be entitled under the Council's leave regulations to 3 months' vacation leave on full pay for every completed 3 years of service, and the Council may award a pension for satisfactory long service.

The successful applicant will be required to pass satisfactorily a medical examination before assuming office.

By law, the City Engineer is required to give security by himself and two sureties jointly and severally in a sum to be determined by the Council for the true and faithful performance of his duties and for the due and punctual accounting for and payment of all moneys received by him. The Council has determined that sum to be £625.

Applications must state age, experience and qualifications and be accompanied by not more than four recent testimonials from some recognised engineering authority and Borough or other Municipal Corporation.

All applications should be addressed to the Council's Agents, Messrs. James J. Sabey and Son, Canberra House, 18-19, Silk-street, London, E.C. 2, not later than 17th July, 1928.

GEO. D. BAYLEY,
Town Clerk.

Georgetown, Demerara, British Guiana,
6th June, 1928. 8905

Harris Institute, Preston.

WANTED, a competent ELECTRICAL MECHANIC in the Engineering Department of the above School, to undertake the Repair and Maintenance of Instruments, Apparatus, and the School Electric Lighting and Power Installation. Applications, stating age, wage required, and giving particulars of training and experience, to be sent with references to the undersigned not later than June 26th.

T. R. JOLLY,
Principal and Secretary.

8759

Perak River Hydro-Electric

POWER COMPANY, LIMITED.

APPLICATIONS are INVITED (by letter only) from properly qualified candidates for IMMEDIATE APPOINTMENT in Malaya :—

TWO INSPECTORS FOR REINFORCED CONCRETE WORK.

Applicants must be experienced clerks of works, thoroughly conversant with general work connected with civil engineering, especially reinforced concrete and levelling ; age 30-40 years ; salary £450 to £550.

Selected candidates for the above posts will only be appointed subject to passing strict medical examination.

Agreement for about 1½ years and free second-class passage to Malaya and home again on satisfactory termination of service.

Applicants must forward details of career, giving particulars of education (general and technical), practical training, and subsequent experience, with names of employers, appointments held, and dates of such employment, together with copies only of testimonials, &c., to the undersigned as soon as possible, as applications will be considered as received, but not later than 13th July, 1928.

RENDEL, PALMER & TRITTON,
Appointments Department.
8890 12, Dartmouth-street, Westminster, S.W. 1.

PUBLIC NOTICES

Blyth Harbour Commission.

ENGINEER.

The Blyth Harbour Commission invite APPLICATIONS for the POSITION of ENGINEER to the Board, which will be vacant on August 31st, 1928.

Candidates, who should be under 50 years of age, must have had a good all-round experience in the supervision and management of harbour work generally, including workshops, plant, dredging, maintenance of quays, piers and waterways.

Applications, stating salary required, age, qualifications and experience, accompanied by copies of not more than three recent testimonials, to be sent to the undersigned not later than July 31st, 1928.

C. E. BALDWIN,
General Manager and Secretary.

Harbour Offices,
Blyth, Northumberland,
June 23rd, 1928. 8883

Required for Important British-

owned Railway in Argentina, FOUR ENGINEERING DRAUGHTSMEN. Must be neat and accurate and qualified as follows :—

(1) Calculation and design of steel railway and road bridges and steel-framed buildings. Must have a sound practical knowledge of structural details and be capable of preparing working drawings and quantities.
(2) Calculation and design of bridge abutments and retaining walls, both in brickwork and armoured concrete. Must have a sound knowledge of the design of armoured concrete railway structures, and be capable of preparing working drawings and quantities.
(3) Preparation of permanent way detail drawings. Must have a thorough knowledge of track construction and be acquainted with modern practice in design and shop work.
(4) Planning of tracks in stations, classification yards and goods yards. Must have a sound knowledge of general railway construction, including drainage and earthworks.

Salaries on three years' contract, £400/£450/£500 per annum. Age not over 35.

Reply, giving full particulars education, training and experience, age, single or married, together with copies (only) of testimonials, to Box Z.Y.X., c/o Davies, 95, Bishopsgate, London, E.C. 2. 8887

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, BOILER-HOUSE SUPERINTENDENT with up-to-date experience in the most modern methods of Steam Raising ; must have a good knowledge of the latest scientific practice with regard to the means for, and obtainment of, the Maximum Thermal Efficiencies. Only first-class man will be considered.—Please write, stating age, experience and salary required, to reference B. H., 8855, The Engineer Office. 8855 A

WANTED, MILLWRIGHT, with Knowledge of Electrical Machinery, for a Concentrating Mill in the South of Spain. Knowledge of Spanish desirable. Salary £40 per month.—Write, stating age, experience, and references, to Box L. 610, Willing's, 133, Moorgate, London, E.C. 2. 8880 A

WANTED, TIME STUDY CLERK, with Previous experience in a Rubber Factory desirable.—Apply, with full particulars, stating salary required, to the MANAGING DIRECTOR, The Avon India Rubber Co., Ltd., Melksham, Wilts. 8881 A

ASSISTANT for Development, Research and Investigation. Thorough technical education essential, with good knowledge of Electrical Design. State age, qualifications and salary required.—NEWTON BROTHERS (DERBY), Ltd., Derby. 8879 A

BOILER and PIPE COVERING, &c., BUSINESS, established 1885, WANTS a live SALESMAN for the Midland district (must have a connection).—Address, stating previous experience and terms required, P4670, The Engineer Office. P4670 A

FOUNDRY Near London REQUIRES SERVICES of a first-class TRAVELLER with established connection amongst users of Light Castings. Salary and substantial commission. Right man can earn £500 a year or more.—Address, 8873, The Engineer Office. 8873 A

FULLY QUALIFIED ENGINEER, Electrical and Mechanical, REQUIRED for large Petroleum Refinery in England, to Take Full Charge of Engineering Department ; must be experienced in modern power production practice and capable of carrying out the design and construction of power and refining units.—Write, stating age and salary required and giving full particulars of experience, to "P. P.," c/o Street's, 6, Gracechurch-street, E.C. 3. 8882 A

GENTLEMAN, with Engineering or Commercial experience, WANTED IMMEDIATELY to take up permanent valuable appointment in London with great future possibilities. Preference to one with about £250 capital available.—Address, P4700, The Engineer Office. P4700 A

MECHANICAL or ELECTRICAL ENGINEERS ; men with University Degrees preferred ; only Works Managers or Assistant Works Managers with practical and commercial manufacturing experience need apply. Age twenty-eight to thirty-five. High salary.—Address, P4693, The Engineer Office. P4693 A

MILLWRIGHT and WORKS ENGINEER WANTED for Maintenance of Contractors' Plant. Preference given to one used to Stone Crushing and Tarmacadam Plant. Salary £250 to commence and commission.—E. E. JEAVONS and CO., Ltd., Civil Engineering Contractors, Tipton. P4674 A

PROCESS ENGINEER and RATE FIXER REQUIRED for Electrical Instrument Factory. Must have had experience in fixing piecework prices by time study methods. Knowledge of Assembly Processes for Small Electrical Apparatus essential. State experience, age, and salary required.—Address, 8807, The Engineer Office. 8807 A

REQUIRED by Leading Engineering Insurance company, YOUNG ENGINEER, well educated and holding Engineering Degree with Metallurgical Works Experience and ability to draw up clear and concise reports. Salary according to ability and experience.—Address, 8892, The Engineer Office. 8892 A

REQUIRED by Firm of Gearing Specialists Having headquarters in London, ENGINEER-SALESMAN to travel throughout the country. Technical training and previous travelling experience essential.—Write, giving full details as to age, experience, education, and salary required, to Box 31, c/o Mather and Crowther, Ltd., 10/13, New Bridge-street, E.C. 4. 8916 A

SURVEYOR REQUIRED for Service Abroad, Experienced Field Surveyor and Map Draughtsman, intimately acquainted with determination of positions by modern astronomical methods.—Send references, state age, experience, and salary required to Box 985, c/o White's, 72/73, Fleet-street, E.C. 4. 8878 A

TRAVELLING REPRESENTATIVES REQUIRED for (a) London (home and export) and South and East Coast districts ; (b) Birmingham district, Midlands and Manchester district, including Leeds and Hull, for Sale of highest grade Machine Tools. Applicants must have held previous similar position with reputable machine tool firm and have established connections amongst users. Salary, commission and travelling expenses offered. Good prospects and permanent position for live man.—Apply in writing, giving full particulars, to P4679, The Engineer Office. P4679 A

WALLIS and STEVENS, Ltd., Basingstoke, REQUIRE TRAVELLING REPRESENTATIVE for Southern District to work from Basingstoke. Principal line, Road Rollers and Road Haulage Plant, &c. Good address and Engineering Knowledge essential. Age 25-35.—Applications by letter in first place only. P4661 A

SITUATIONS OPEN (continued)

WORKS MANAGER is REQUIRED, Age About 30 years, to Take Complete Inside Control of Factory in North of England. Applicants must have knowledge of Chemistry, Steam Plants, Hydraulic Presses, and have received training in factories where energy, output and efficiency have been required. Commencing salary £500 per annum.—Address, stating full particulars, P4675, The Engineer Office. P4675 A

WORKS MANAGER Small Cement Works, South America, dry process. Working knowledge Spanish desirable, not essential. Salary according qualifications. Continued ability work at altitude around 13,000ft. essential.—Address, P4692, The Engineer Office. P4692 A

AUTOMOBILE CHASSIS DRAUGHTSMEN REQUIRED. Only good men with wide experience need apply. Give fullest engineering experience, present employment or if disengaged. State age and salary required.—Address, P4683, The Engineer Office. P4683 A

COMPETENT DRAUGHTSMAN, Able to Take Charge of complete contract, preferably with a knowledge of modern Dairy Machinery, REQUIRED by Firm in S.W. London. Permanent and progressive position to the right man. State age, experience, and salary.—Address, P4677, The Engineer Office. P4677 A

DIRECTOR WANTED for Large New Engineering undertaking involving about one million capital already arranged. Full participation in preliminary syndicate.—Address, P4701, The Engineer Office. P4701 A

DRAUGHTSMAN, Accustomed to Design and Estimate Light Steel Roofs and Buildings ; permanent position, London. State age, past experience, and salary required in confidence.—Address, P4696, The Engineer Office. P4696 A

DRAUGHTSMAN, Experienced in all Classes of Pneumatic Conveying Plant. Only those thoroughly experienced need apply. State salary required and send copies of recent testimonials.—Address, P4697, The Engineer Office. P4697 A

DRAUGHTSMAN, Familiar with and Capable of designing and detailing Coal Drying Plant. Only those with previous experience need apply. State salary and qualifications, together with references.—Address, P4699, The Engineer Office. P4699 A

DRAUGHTSMEN.—First-class JIG and TOOL DESIGNERS REQUIRED for modern Motor Car Plant in Midlands. Only those having all-round experience in this class of work need apply.—Address, 8893, The Engineer Office. 8893 A

DRAUGHTSMAN, Fully Conversant with Water-tube Boilers and must be capable of designing and detailing the various components connected with W.T. Boilers.—Address, stating salary and qualifications, together with references, P4698, The Engineer Office. P4698 A

DRAUGHTSMAN REQUIRED, Used to Elevator and Conveyor, also Light Structural Steel Work. State age and salary required.—Address, 8919, The Engineer Office. 8919 A

DRAUGHTSMAN REQUIRED for Tool D.O. Should have experience of Tool Design for small and medium-size work. Knowledge of Press Tools desirable. State experience, age, and salary required.—Address, 8912, The Engineer Office. 8912 A

DRAUGHTSMEN (SENIOR) REQUIRED in Midlands for Turbine and Hydraulic Details. Particulars of training, experience, age, salary required, and date free to be stated.—Address, 8913, The Engineer Office. 8913 A

JUNIOR and SENIOR DRAUGHTSMEN, Experience in Steel-frame Buildings, for works office near London. State experience and salary expected.—Address, 8915, The Engineer Office. 8915 A

MECHANICAL DRAUGHTSMAN REQUIRED for London office. Experience in Aerial Ropeways an advantage. Must be quick and reliable worker.—Address, giving age, experience, salary required, and when at liberty, 8914, The Engineer Office. 8914 A

REQUIRED, First-class JIG and TOOL DRAUGHTSMEN, preferably with experience on Jigs for Internal Combustion Engines. First-class men only need apply.—Apply, stating age and full particulars, to BRISTOL AEROPLANE COMPANY, Ltd., Aero Engine Dept., Filton, Bristol. 8876 A

STRUCTURAL DRAUGHTSMEN.—SENIOR and ASSISTANT DRAUGHTSMEN REQUIRED, accustomed to Detailing Constructional Steel Work.—Apply, stating age, experience, salary required, and when at liberty, to CHIEF DRAUGHTSMAN, Redpath, Brown and Co., Ltd., Trafford Park, Manchester. 8874 A

SUGAR MACHINERY DRAUGHTSMAN REQUIRED. First-class senior man with good experience. Must state age and salary required.—Address, 8860, The Engineer Office. 8860 A

WANTED, a First-class MACHINE SHOP FOREMAN for Textile Engineering Works on East Coast of Scotland ; must have expert knowledge of modern machine shop methods and machine tools, also rate fixing and planning. Only first-class man will be considered.—Address, with references, stating age and experience, P4702, The Engineer Office. P4702 A

FOREMAN ENGINEER, Live Up-to-date Man, with knowledge of modern shop practice, REQUIRED.—Applications, giving full particulars of previous experience, age, salary required, and copies of references, to Box 767, T. B. Browne Advertising Offices, 163, Queen Victoria-street, London, E.C. 4. 8908 A

A GOOD FITTER and TURNER REQUIRED, with practical experience in the maintenance of Lancashire Boilers, Pumps, Engines, &c. Must have served a regular apprenticeship and be accustomed to the work of a large institution. It is useless to apply without these qualifications. Age not to exceed 35 years. Wages 67s. 6d. per week, subject to deductions under the Asylum Officers' Superannuation Act, 1909. A cottage will be available for a married man at the low rent of 7s. 9d. per week.—Apply by letter, stating experience, with copies of two recent testimonials, to the STEWARD, Netherne Mental Hospital, Coulsdon, Surrey. 8909 A

PATTERN MAKERS (ENGINEERS), PERMANENCY. Apply, P. J. SMITH, 2a, Wynyatt-street, London, E.C. 1. 8797 A

SITUATIONS WANTED

ADVERTISER, A.M.I.M.E., Age 41, Late London Manager for old-established engineering firm, recently discontinued business, SEEKS responsible POST.—Address, P4690, The Engineer Office. P4690 B

A SKILLED ENGINEER, Mechanical and Electrical, is DESIROUS of POSITION as REPRESENTATIVE for the Midlands or East Midlands, experienced in this area.—Address, P4704, The Engineer Office. P4704 B

ADVERTISER (41) DESIRES POSITION, Specialist in organisation and production, gen. eng., railway works, constructional and contractors ; wide exp. managerial positions.—Address, 8628, The Engineer Office. 8628 B

For continuation of Small Advertisements see page 3.

A Seven-Day Journal

The British Steel Industry.

IT is announced that the two largest steel-producing organisations in the United States—namely, the United States Steel Corporation and the Bethlehem Steel Corporation—have between them formed an organisation to be known as the Steel Export Association for the purpose of combining their export sales departments in a strong attempt to obtain an increased volume of foreign steel orders. The authorised capital stock of the first-named company is 1100 million dollars and of the second company 400 million dollars. The news of this combination will scarcely be welcome to British steel manufacturers, particularly in view of the fact that on Thursday of last week, June 21st, Mr. Baldwin, replying to a deputation from the National Federation of Iron and Steel Manufacturers, was unable to hold out any hope that its appeal for a farther inquiry into the establishment of a safeguarding duty for the industry would be granted in the lifetime of the present Parliament. Mr. Benjamin Talbot, the President of the Federation, urged that the depression within the industry was such as to render action imperative. The Prime Minister, himself a heavy sufferer by losses in the steel industry, could not apparently see any possibility of the Government reversing in the immediate future the decision on this subject to which it came some time ago. It may be recalled that the Civil Research Committee, to which the Cabinet referred the first application for a safeguarding duty received from the industry, reported that the safeguarding of a basic industry of such magnitude would have wide repercussions, and might be held to be in conflict with the Government's declaration regarding a general tariff.

The Singapore Floating Dock.

ON Thursday of last week, June 21st, the larger of the two sections of the 50,000-ton floating dock which Swan, Hunter and Wigham Richardson, Ltd., have built for the Admiralty, left Wallsend on its 8600-mile voyage to Singapore. The portion is in charge of four tugs belonging to the towage contractors, Messrs. L. Smit and Co., of Rotterdam, a firm which previously has had much experience in the towing of docks. The section which left last week contains most of the plant and machinery for the complete dock, and with the crew, ballast, fuel and towage gear weighs about 12,350 tons. Its average speed during the voyage is expected to be about 3 miles an hour, and it is anticipated that it will arrive at Singapore about November 14th. The tugs are provisioned for the whole voyage and will not be dependent upon supplies from the dock. Coal will be taken in at Algiers, Malta and Port Said, and only a comparatively small quantity will be used on the dock itself in connection with the pumping plant. In case of excessively bad weather or exceptional emergency it has been arranged to keep the dock stationary until the conditions improve, and for that purpose two 5½-ton anchors have been provided. Two divers completely equipped accompany the dock in case their services are required. The complete *personnel* of the tugs towing the section numbers about eighty. In addition, the builders have on board a small number of skilled Tyneside workers. The passage of the Suez Canal is expected to occupy about two days. Special preparations have been made in the Canal and dredging has been proceeding for the past six months. The buoys marking the channel will be temporarily removed so as to increase the very narrow margin available for the passage of the dock. The second and lighter section of the dock was due to leave Wallsend this week. It is expected to arrive at Suez in time to pass through the Canal in proximity to the first section.

A Motor Cargo Vessel for the Clan Line.

THE single-screw motor cargo vessel "Clan Macdonald," which has been built by the Greenock Dockyard Company, Ltd., to the order of the Clan Line Steamers, Ltd., and engined by J. G. Kincaid and Co., Ltd., ran successful trials on the Clyde on Friday last, June 22nd. She is noteworthy as being the first cargo vessel to be propelled by single-screw double-acting four-cycle engines of the Kincaid-Harland-B. and W. pattern, and her engines are the first of their kind to be built at Greenock. The new vessel has a length of 430ft. 3½in., with a breadth moulded of 57ft. 6in. and a depth moulded of 39ft. 6in. She has a designed deadweight carrying capacity of 9500 tons on a draught of 27ft., and her eight-cylinder, single-screw motor has an output of 5200 B.H.P., which is designed to give a service speed of 14 knots. It is interesting to learn that the Clan Line has also under construction a vessel with an identical hull, in which triple-expansion steam machinery, with an exhaust steam turbine working on the Bauer-Wach system, is to be fitted. When complete, these two vessels should enable an interesting economic comparison of the two types of propelling machinery to be made. In the course of a speech made at the trial trip, Mr. James S. Kincaid, the chairman of J. G. Kincaid and Co., Ltd., referred to the present difference in price between steam engines and internal combustion engines. He said that his firm had gone to considerable expense in putting down plant which enabled it to produce marine oil engines as economically as possible. It had now the plant, the men, and the requisite experience, but it was only by a certain amount of mass production that a reduction in price could be obtained. He expressed the hope that shipowners would place orders which would enable the engineers to go on producing in volume with the modern plant with which they had equipped their shops.

Glasgow's New Electricity Manager.

AT a meeting of the Glasgow Corporation, which took place on Thursday, June 21st, Mr. Herbert Bell, the electrical engineer of the City of Hull, was appointed general manager of the Glasgow electricity department, in succession to Mr. R. B. Mitchell, who retired on May 31st on a superannuation allowance. In his work at Hull, which embraced—excluding the war period—over twenty years of service, Mr. Bell has had the entire responsibility of developing the Hull electricity undertaking, both on its engineering and its commercial side. Such work has naturally brought him into close touch with dock and railway electrification problems, and during his term of office he carried out in collaboration with the railway company's dock engineer the complete electrification of the King George Dock, belonging to the London and North-Eastern Railway Company. Mr. Bell has also made himself familiar with the contemporary electrical practice of other countries, especially that of Canada and the United States. His experience of the electrical requirements of the heavier industries connected with the city and port of Hull should also prove valuable in his new post. Mr. Bell is a member of the Institution of Electrical Engineers, and has served as a chairman of the North Midland Centre. He holds the rank of Major (Retired) in the Royal Engineers and was awarded the Territorial Decoration for his services.

Sir Westcott Abell's New Appointment.

THE announcement is made that the special committee appointed by the Council of Armstrong College, Newcastle-upon-Tyne to decide upon a successor to Dr. J. J. Welch, has unanimously agreed to recommend the appointment of Sir Westcott Abell to the Chair of Naval Architecture. Professor Welch will retire at the end of September, and Sir Westcott Abell is expected to take up his duties on October 1st next. Sir Westcott was educated at the Royal Naval Engineering College, Keyham, and the Royal Naval College, Greenwich, and after serving some time in the Royal Corps of Naval Constructors and as Professional Secretary to the Director of Naval Construction he returned to Greenwich as Instructor in Naval Architecture, which position he held from 1907 to 1910. From 1910 to 1914 he occupied the Chair of Naval Architecture at Liverpool University, and during that period began his work on the Board of Trade Load Line Committee. In 1914 Sir Westcott was appointed Chief Ship Surveyor to Lloyd's Register of Shipping, which office he continued to hold until the early part of the present year, when he retired to take up private consulting practice. During the war Sir Westcott Abell rendered good service to the country as a member of the Merchant Shipbuilding Advisory Committee and of the Admiralty Shipping Council and also as Technical Adviser to the Controller of Shipping. For these services he was given the honour of K.B.E. in 1920. The University of Durham is to be congratulated on securing such a distinguished naval architect to continue the work of Professor Welch at Armstrong College.

The Causes of Motor Accidents.

THE results of an analysis of the causes of accidents on the roads of this country in which motor vehicles were concerned were given by Sir Henry Maybury, Director-General of Roads, Ministry of Transport, at the annual conference in London last week of the Institution of Municipal and County Engineers. In the road traffic area lying within 25 miles of Charing Cross, Sir Henry said, 287 accidents in which there had been any question of defect in the vehicles or in the condition of the road, had been inquired into. It was found that in 99 of these cases, involving 9 deaths and 41 cases of injury, mechanical defects had been the cause. Road conditions were responsible for 159 accidents, involving 50 deaths and 64 cases of injury. The chief causes of the accidents and their numbers had been:—Bad road surfaces, 80; faulty steering gear, 42; bad reinstatement, 28; skidding, 18; faulty brakes or back axle failures, 10. Outside the London traffic area the number of people killed on the highways of Great Britain in 1927 had been 488, while 1161 had been injured. The causes and the respective numbers of killed and injured in those accidents had been:—Negligent driving, 160 killed and 346 injured; bad judgment, 108 and 232; road conditions, 64 and 188; mechanical defects, 51 and 292; other causes, 105 and 103. Analysing the accidents attributable to road conditions, he said that skidding had accounted for 30 deaths and 134 cases of injury; bad road surfaces for 6 and 7; dangerous corners for 13 and 20; inefficient signposting for 7 and 3; and railway level crossings for 6 killed and 23 injured. From Sir Henry's figures it is clear, as one might well have concluded without them, that negligent driving and bad judgment are responsible for the bigger number of road accidents. In addition they show what perhaps was not obvious before, that road conditions are a more fruitful cause of mishap than mechanical defects, or, in other words, that the roads are more dangerous than the vehicles using them.

The Mersey Tunnel.

AT the beginning of December, 1925, the Joint Mersey Tunnel Committee decided to let to Edmund Nuttall, Sons and Co., of Trafford Park, Manchester, the contract for the preliminary work in connection with the construction of a tunnel under the river Mersey, to connect Liverpool and Birkenhead. The contract covered the sinking of the working shafts at the two ends and the boring of two 15ft. by 12ft. preliminary headings under the river. The contract price was £443,079 14s. Last week the Joint Committee decided, subject to the concurrence of the Ministry of Transport, to let to Messrs. Nuttall the contract for the completion of the under-river portion of the tunnel. For this second portion of the work the contract price is £1,413,601. The work now to be done will consist of enlarging the preliminary headings into the finished tunnel of 44ft. diameter. The tunnel is to be lined with cast iron segments, between which and the sandstone of the river bed cement mixture will be injected under pressure through holes that will subsequently be plugged up. Inside the tunnel an upper and lower roadway will be constructed for heavy and light traffic respectively. The total estimated cost of the tunnel and its approaches is £4,750,000, towards which the Treasury is making a grant of £2,375,000. The preliminary work on the approaches is now well advanced. Of the two approaches on the Liverpool side one is within 60ft. and the other within 120ft. of being completely bored. On the Birkenhead side one of the approaches has been completed, while the other has to be driven only a farther 30ft.

Charing Cross Bridge.

IT is understood that the scheme advanced by the committee of engineering experts for the removal of Charing Cross Station to the south side of the river and the construction of a new road bridge in place of the existing railway bridge, has received the full support of the Cabinet, and that the Government has intimated that it is prepared to meet 75 per cent. of the estimated cost of the scheme. This scheme includes the widening of Waterloo Bridge, and its cost is estimated at £10,770,000, so that the Government's contribution, to be derived from the Road Fund, would be something like £8,000,000. Negotiations are at present proceeding between the Ministry of Transport on the one hand and the London County Council and the Southern Railway on the other regarding the carrying out of the proposal. In the case of the County Council, the question is in the hands of the Improvements Committee, and it is thought likely that the Council will eventually approve of the scheme, particularly because it will secure a great public improvement at an expense of only about 2¾ millions to the ratepayers. The attitude of the Southern Railway has not yet been disclosed. It is known that it has received numerous representations from users of its lines and from various bodies in Kent regarding the inconvenience which it is alleged passengers will be put to by the transference of the station to a site adjoining Waterloo Station. It is also recalled that on one occasion a year or two ago, when the transference was first suggested, the chairman of the railway company said it would be suicidal to consent to the change. Nevertheless, strong hopes are expressed by those in favour of the scheme that the railway company will not stand in the way of its being carried out.

A New Canadian Pacific Order.

WE are able to announce that Mr. E. W. Beatty, the chairman and president of the Canadian Pacific Railway Company, who is at present in this country, has placed with the Fairfield Shipbuilding and Engineering Company, Ltd., of Govan, Glasgow, the order to construct a 21-knot passenger liner of the "Empress" class, which will be used in the company's Trans-Pacific service. The new liner will have a measurement of something over 25,000 gross tons, and she will be propelled by twin-screw single-reduction geared turbines. Steam will be generated in high-pressure water-tube boilers, working in connection with auxiliary Scotch boilers, the general arrangement being similar to that which has been installed with such success in the "Duchess" class liners. It is interesting to recall that to the Fairfield Company was entrusted the reconditioning of the "Empress of Australia," the new machinery for which vessel was described in THE ENGINEER of June 17th, 1927. In our issue of June 1st a full account of the high-pressure turbine machinery of the "Duchess of Bedford" was given.

An American Laboratory of Insurance Engineering.

No. II. (*Conclusion*).*

ALTHOUGH the work of the Underwriters' Laboratory is extremely varied and diverse, as was shown in the previous section of this article, the part which relates to the construction and protection of buildings is of more particular interest to engineers, and it is that part of the work which is now dealt with.

Structural Tests.—In the consideration of structural materials and building construction, the Laboratory—as representing insurance interests—is concerned mainly with fireproofing and fire-resistant properties, and only in secondary degree with questions of strength. Consequently an important feature of the work consists in actual tests by fire. These are made by means of special gas-heated furnaces, under conditions which permit of close control and record of temperatures, as well as accurate determination of the performance of the material under test.

The standard time-temperature curve for such fire tests is shown in Fig. 4. Thus, the furnace temperature is required to reach 1000 deg. Fah. at the end of the first five minutes, increasing steadily to 1300 deg. at ten minutes, 1550 deg. at thirty minutes, 1700 deg. at one hour, and then more slowly to 1850 deg. at two hours, 2000 deg. at four hours, and 2300 deg. at eight hours, which is the duration of the furnace test. This fire test is followed immediately, in many cases, by a quenching test, a stream of water from a standard fire hose being played upon the test specimen for a specified time. These combined tests constitute a severe trial for any building material or equipment.

Floor and roofing materials, supporting columns and floor girders, load-bearing walls, the protection or fireproofing of steel columns and floor framing, and the efficiency of steel sash windows and wire glass, are subjects of study and test as regards buildings. Doors—sliding, swinging and rolling—skylights, windows and ventilators are other related subjects, as well as fire escapes and equipment for fire protection, fire alarm and fire extinguishing.

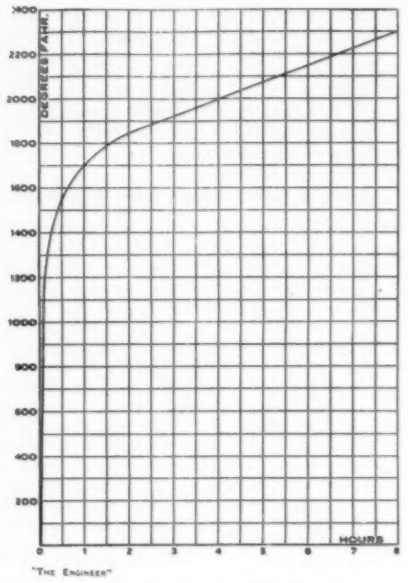


FIG. 4—FIRE TEST TEMPERATURES

Tests of Columns.—Fire conditions as affecting the structural framing of buildings were the basis of an extended series of combined fire and load tests on steel, cast iron, reinforced concrete and timber columns which were carried out at the Laboratory a few years ago in conjunction with the United States Bureau of Standards. These tests were conducted largely to determine the best materials and methods of fireproofing the columns, which were of various designs. Heavy timber construction may be self-protective to some extent by surface charring which prevents the burning of the interior, and this factor is considered in the so-called slow-burning or mill type timber construction for factory buildings and warehouses. Concrete, if unprotected, is likely to spall and split. Both steel and cast iron present fire hazards if not adequately protected, the former being liable to bend and collapse under load when weakened by heat, and the latter being liable to crack and shatter if heated and then suddenly cooled by a stream of water.

Each column was heated in a furnace, and while still standing in the furnace was tested to failure under loads applied by an hydraulic press. Several of the columns, while in the furnace and carrying a load, were subjected to a high-pressure stream of cold water from a fire hose, simulating the actual conditions in a burning building. Some of the unprotected steel columns failed in about twenty minutes, while similar columns, heavily fireproofed, stood for more than eight hours under load, and their final failure was of a much less serious character. The fireproofing casings included brick, hollow tile, gypsum block, concrete 2in. and 4in. thick, and metal lath and plaster in one and two layers.

The column testing furnace is 7ft. square in plan and 14ft. high. It is heated by gas flames from burners in the walls, and surmounted by a hydraulic press of 245 gross tons capacity, having an inverted cylinder with a 36in. plunger. This plunger applied the load directly upon the head of the column, the foot of which rested on a grillage of rolled steel joists embedded in concrete and forming part of the floor of the furnace. Two of the fire-brick side walls, with the burners, are stationary. But the others are removable, being handled by an overhead crane. When a column has been placed in the furnace these walls are replaced, secured by clamps, and the joints sealed. The roof is of concrete blocks carried by steel joists. Flues carry off the products of combustion.

Pyrometers measure the temperatures of furnace and column, while gauges measure the vertical expansion and contraction movements, and other gauges record the test pressures. Peep holes in the walls, fitted with mica panels, enable the behaviour of the column to be kept under observation, and frequent readings are made of the several instruments. A steam engine indicator was used to give an approximate record of the load carried by the column and to show the load during the period of failure. Its pressure chamber was connected to the main cylinder of the ram, while the recording cylinder was actuated by a cord attached to the plunger. In this way the resulting card diagram indicated on axes at right angles to each other the pressures in the main cylinder and the corresponding position of the plunger.

Floor Test Furnace.—For making fire tests of floor materials, there are two permanent horizontal steel frames, 14ft. by 16ft. in plan, which represent the framing of a building and in which can be built any desired form of floor panels. Beneath this frame is a fire-brick floor with gas burners and pyrometer tubes. Loading is applied to the test floor by stacking pig iron upon it.

In the view of this furnace—Fig. 5—the man is standing on the fire-brick floor, the test panels being empty. Steel joists for these panels will rest on the ledge above his head, and the spaces between these joists will be filled with the concrete slab, hollow-tile block or other floor material to be tested. The four upper openings are flues for the escape of gas and products of combustion. The two lower openings are peep holes, of which are two in each side of the furnace. These two furnaces serve for testing and classifying either floor or ceiling constructions under both fire and load. Work of this kind has been of great assistance in determining the different stresses, resulting from such combined tests.

FIG. 5—FLOOR TESTING FURNACE

FIG. 6—FRAME OF BUCKETS FOR TEST OF SPRINKLERS

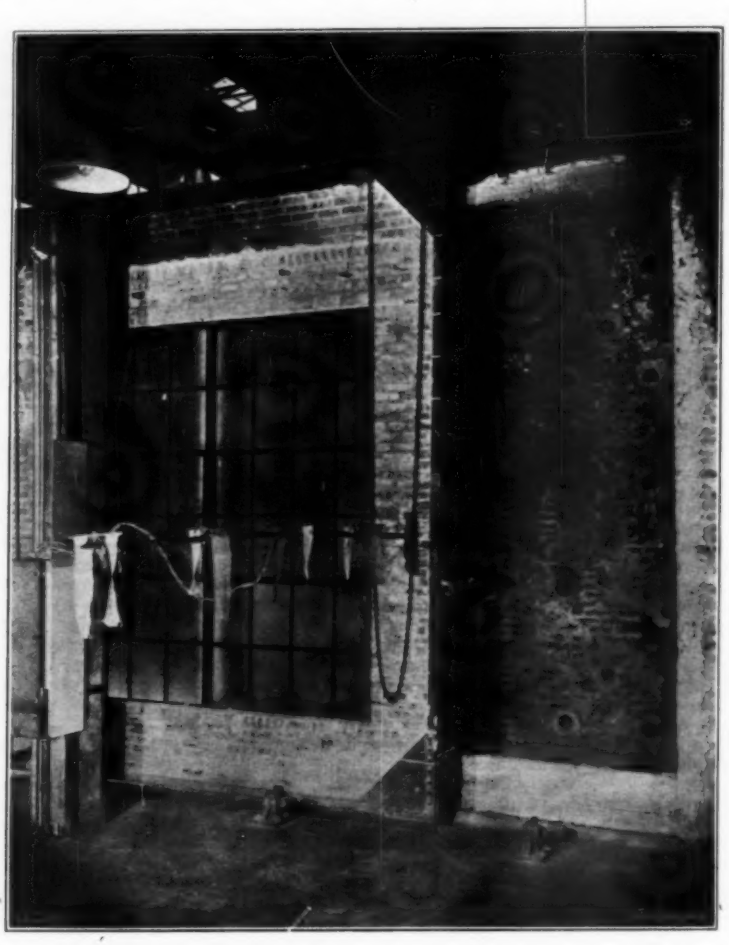


FIG. 7—WINDOW TESTING FURNACE

Window Testing Furnace.—Fireproof or fire-resistant properties of windows are of special importance from the point of view of excluding outside fire—as from an adjacent burning building—and this is more particularly the case in view of the rapidly increasing use of very large window or glazed areas in the walls of modern industrial buildings. In some

* No. I. appeared June 22nd.

such buildings this glazed area is very nearly 100 per cent. of the wall area. Furthermore, the efficiency of these windows is important in view of the large number of manufactured types of metal-sash window construction. Wood sash for buildings of this class is now confined largely to structures for which humidity or fumes make metal less desirable.

Wire glass has a great resistance, and is not liable to destructive fracture, but under intense heat it may soften and bend or even flow, so as to cause openings, admitting smoke and flame. Light metal framing of windows and skylights may warp or fail and cause similar dangerous openings. It is highly important therefore to know how nearly the various manufactured products come to meeting the specific requirements of the Laboratory as to fire resistance, and that is the purpose of the furnace tests.

For tests of windows, doors, partitions and similar parts, there is a vertical furnace, 10ft. by 16ft., with a horizontal depth of about 18in. The back and sides are of fire-brick, the back being pierced with gas burner pipes and pryometer tubes. The face of the front wall is formed by a removable steel frame in which is built the wall, window, door or partition material to be tested. There is a number of these frames, so that several can be got ready for a series of tests. They are handled by an overhead crane from the stock room to the testing floor and furnace, as shown in the plan, Fig. 1, in the previous article.

When a frame or panel is ready for test, it is carried by the crane and set in place to form the front wall of the furnace, where it is clamped and sealed. Then the gas burners are lighted. After the prescribed eight-hour fire test, the frame is released and the crane swings it over to an open floor space, where a stream of water from a standard fire hose is played upon it for a prescribed period. Detailed observations are made for a report on the test.

In Fig. 7 is shown a panel being placed in position, the frame being filled with a steel sash factory window in a brick wall. The two roller clamps at the floor hold the panel tight against the side walls of the furnace. Part of the rear wall of the furnace with its gas nozzles or burners is shown at the right, beyond the test panel. On a wire stretched at right angles to the window are hung several light rags, to indicate the distance at which radiant heat will ignite inflammable material within the room protected by such a window.

Standing in front of this furnace, a manufacturer of steel sash or factory doors has an opportunity of seeing how his product serves its purpose when subjected to the crucial fire test. Weakness or defective details may be evidenced in various ways, such as the transmission of too much heat—causing ignition of goods in the room, the entrance of flame through the joints and by the distortion of the parts, or the loosening of the wired glass owing to incorrect design or faulty construction. Until a few years ago, manufacturers did not believe it possible to build practicable and economical doors and windows which would withstand the severe test conditions imposed as a pre-requisite to approval by the Laboratory and by city fire departments, building departments and insurance concerns. But by careful study and design they are now able to put on the market products of sufficient fire-resistant quality to pass these tests. The result means increased safety for the buildings and their contents and occupants. Windows, doors, and automatic fire doors are tested in this way, with the full complement of hardware attached, just as they would be installed in a building.

Walls and Partitions.—Load-bearing wall construction can be tested under fire and load combined in the large furnace just described. In this case the wall or partition, which may be as much as 2ft. thick, is built in the steel frame but with the bottom carried by a beam resting on a row of hydraulic jacks, which are seated upon the bottom member or girder of the frame. These jacks, with 6in. stroke, have 5½in. plungers, giving a total bearing area of 190 square inches, so that with hydraulic pressure of 2630 lb. created by the pumps, a total load or pressure of nearly 250 tons may be exerted upon the base of the wall. At the same time one side of the wall is exposed to the flames and heat of the furnace.

While the wall is still hot, or perhaps even incandescent, it is removed from the furnace, and water is played upon it from a hose for twenty minutes. This indicates the resistance to the combined cooling, eroding and impact effects of the powerful jet of water.

Roof Coverings.—Still another furnace provides for testing roof material attacked by fire from below, and also from above, as would be the case with burning brands falling upon it. In addition, it is so arranged as to have strong currents of air blown upon the deck covered with the material under test, in order to represent wind conditions. As a result of the relative values of roof coverings developed by these tests, manufacturers have learned how to make better roofing materials with little, if any, increase in cost and price. In addition, they have resulted in a trend towards the use of the more efficient kinds of roofing by architects, builders, house owners and engineers, these last being concerned more particularly with safe and economical roofing for factories and industrial establishments.

Fire Tests for Safes.—A special line of tests is that of determining the efficiency of safes, which may contain valuable materials, documents, records or drawings. In the test of a first-class safe, the furnace temperature is raised to 1000 deg. Fah., at the end of five minutes, 1700 deg. at one hour, 1850 deg. at two hours, 1925 deg. at three hours, and 2000 deg. at four hours. There are many failures, as might be expected, but the information so obtained is invaluable to the manufacturer in enabling him so to improve the design of the safe that it will give better results in the next test. On the other hand, many makers have been agreeably surprised to find papers and other contents intact after the fire test. To increase the severity of the test, the hot safe is subject to impact or drop tests in which it falls 30ft. to a concrete foundation. This test represents the case of a safe falling in the wreck of a building destroyed by fire. After this drop test it goes into the furnace for another hour, thus representing the case of a safe buried in burning wreckage. Numbers of manufacturers of safes have availed themselves of this opportunity for developing the construction of safes which will protect their contents even under such severe conditions.

Fire Protection and Safety Equipment.—In this class of study, research and test may be included sprinkler apparatus, fire hose, pumps and piping, friction and flow capacity of pipes, fire hydrant and valve designs, fire extinguishers of all kinds, fire-escapes—exterior and interior—automatic alarms or warning devices, relief ventilators to carry off gases and fumes, fireproof stage equipment of theatres, protection of machine bearing to prevent over-heating or to give warning if they become overheated. Also non-slip stairs and gratings, safety ladders and scaffolds, safety devices for elevators, or lifts, and various guards and devices to protect workmen from machinery in motion and other industrial hazards.

Of a special character are investigations into the design of apparatus for the metering of water taken from public or municipal water supply by private fire-protection systems. One class of such devices consists of a weighted check valve with a small disc meter in a by-pass around the valve. Comprehensive series of tests have been made on sprinklers, sprinkler apparatus, and the planning of sprinkler systems. Also on flame arresters for oil tanks, and foam apparatus for smothering oil fires.

Sprinkler Tests.—For the series of test on sprinklers and sprinkler systems, which extinguish fires within buildings, there is a room having a waterproofed floor with ample drainage facilities and water supply. Under the ceiling, movable false joists of timber can be arranged to represent the girders or beams of any proposed spacing. The ceiling and joists are painted black and marked off in squares by white lines. With the joists spaced as desired and sprinkler heads set in the proposed positions, water is turned on for a prescribed period. As soon as the sprinklers are out of action, any dry spaces on the ceiling and joists are outlined in white chalk. They are then plotted on charts ruled to correspond with the painted squares. An examination will then show if the water was distributed uniformly or whether the joists interfered with the jets or spray. It may then be desirable to change the position of the sprinkler heads to get better results.

Water discharged from sprinklers should be diffused uniformly over the floor area assigned to each sprinkler head. To determine this distribution, a frame containing a series of buckets 1ft. square is set in place, covering an area 12ft. by 12ft. under the sprinkler. After the sprinkler has been in operation for a time, the water is turned off, and the depth of water in each bucket is measured and recorded. In this way the amount and proportion of water sprayed on each square foot of floor can be determined.

In Fig. 7 the men are seen uncovering the set of 144 buckets in the frame, ready for a test. A test had already been made on the ceiling, and the dry spots duly indicated by chalk marks.

In the design of modern buildings the features of fire-prevention, fire protection and accident prevention are among the problems to be considered by engineers and architects. The economic importance of all this research, investigation and development work carried out at the Underwriters' Laboratory may be realised when it is stated that in 1925 the total property loss by fire in the United States exceeded £100,000,000. And of this great total it is estimated by the National Board of Fire Underwriters that about 30 per cent. may be credited to industrial and manufacturing establishments.

The Port of Southampton.*

By F. E. WENTWORTH-SHEILDS.

AMONG the seaports for which our home country is justly famous, Southampton occupies a remarkable position. In point of size, it is comparatively small. The present dock estate covers only 240 acres, and contains some four miles of quay. As compared with the thirty miles of quay in London, or thirty-seven miles in Liverpool, four miles seems insignificant, and yet Southampton has the proud record of being the premier passenger port in the Kingdom,† and the third in the matter of tonnage of vessels entered and cleared. Moreover, its record for the rapid handling of cargo is by no means poor. How has this record been brought about and how is it maintained? The answer to these questions is a matter of interest to engineers, as it is largely owing to their labours in the past that this attractive town has acquired a fame which is now world-wide.

Natural Advantages.—Nature has been kind to Southampton. The fifteen miles of approach to the docks along the Solent and Southampton Water are all land-locked and sheltered from every quarter. For the most part, this approach is naturally wide and deep, and where necessary it has been improved by dredging. This natural formation has a curious history. It seems that at one time Southampton Water and the eastern part of the Solent were a fresh-water river, well above sea-level, but fed by streams much greater than those which enter it to-day, so much so that they eroded the valley to a width of about three miles, and to a depth, in places, of about 100ft. At a comparatively recent date—one authority says about 1400 B.C.—a land subsidence took place and the valley which had been the route of a great stream of fresh water, became submerged and changed into the deep arm of the sea which it is to-day.

Another natural advantage possessed by the port is the double high tide. A second high water occurs about two hours after the first. Between the two high waters the sea-level falls slightly, but so little that the practical effect is that of a prolonged high water lasting about three hours. This phenomenon is of great value for certain operations such as manœuvring a very large ship into dry dock—a process which occupies an hour or more and calls for quiet water while it is being carried out. It also insures that there is no fear of even the deeper-draught ships running aground in the 35ft. channel, provided that they avoid times of extreme low water. The berths are generally dredged to such a depth that the vessels lie afloat all the time.

Recent Developments.—Although the port has been of both military and commercial importance, it was not until about ninety years ago, when the docks and railway were first built, that it began to take its proper place. At that time the Southampton Dock Company was formed, and was fortunate in securing the services as engineers of Francis Giles and his son Alfred, to whose courage and foresight the success of the docks is very largely due. They built the Inner and Outer Docks, the Itchen Quay Extension (Berths Nos. 29-33), the Empress Dock, and four graving docks. Although the railway and docks were quite separate undertakings, Francis Giles fortunately planned both. He realised that for the quick-handling of passengers and cargo the ship and the railway line must be brought as near each other as possible. He devised a lay-out on which but little improvement has been found necessary after ninety years' working.

In 1892 the docks had fallen into financial difficulties. The London and South-Western Railway was at that time managed by Sir Charles Scotter, a man of vision and energy, and he persuaded the company to advance capital for the building of the Empress Dock, and eventually to buy the docks as a going concern. The railway company subsequently furnished the whole estate with machinery and equipment, and built additional quays. The docks of to-day are therefore largely the result of the enterprise of the railway company which owns them. The usefulness of the port is also due to the Southampton Harbour Board, who have given facilities to the railway company, and have themselves dredged and lighted the approach channel in Southampton Water. The docks as they exist to-day are shown in the engraving on page 706. The quays shown on the plan and the traffic which they accommodate may now be briefly described.

Outer Dock.—All the docks and quays, even the oldest, are still in active use. The Outer Dock, which was opened in 1842, has a depth of 18ft. at L.W.O.S.T., and 13ft. more at H.W.O.S.T. The steamers which use it belong to the Southern Railway Company, and convey passengers, mails and cargo to the Channel Islands and the northern ports of France. A large homeward traffic is also carried, consisting mostly of produce, such as fruit, flowers, tomatoes, and potatoes. A fair amount of goods is brought over from France for transhipment to America.

Inner Dock.—This dock was opened in 1851. It is the only basin in the port which is not tidal. It is approached from the Outer Dock by a passage closed by a single pair of gates and consequently vessels can only enter it at high tide. On account of the double tide, however, the gates are open for about six hours every day. The northern side of the dock is devoted to the grain trade. At present this is small, but a scheme is under consideration for improving transport facilities in the hope of increasing it. The south side of the dock is used for the import of foreign fruit, which is landed at the quay and taken into the shed alongside. At one end of the quay are large sale-rooms and offices where the cargoes are sold as fast as they enter. The arrangements are such that the fruit can be delivered within a day or so of its arrival. The west side of the dock is used for unloading sea-borne coal and timber.

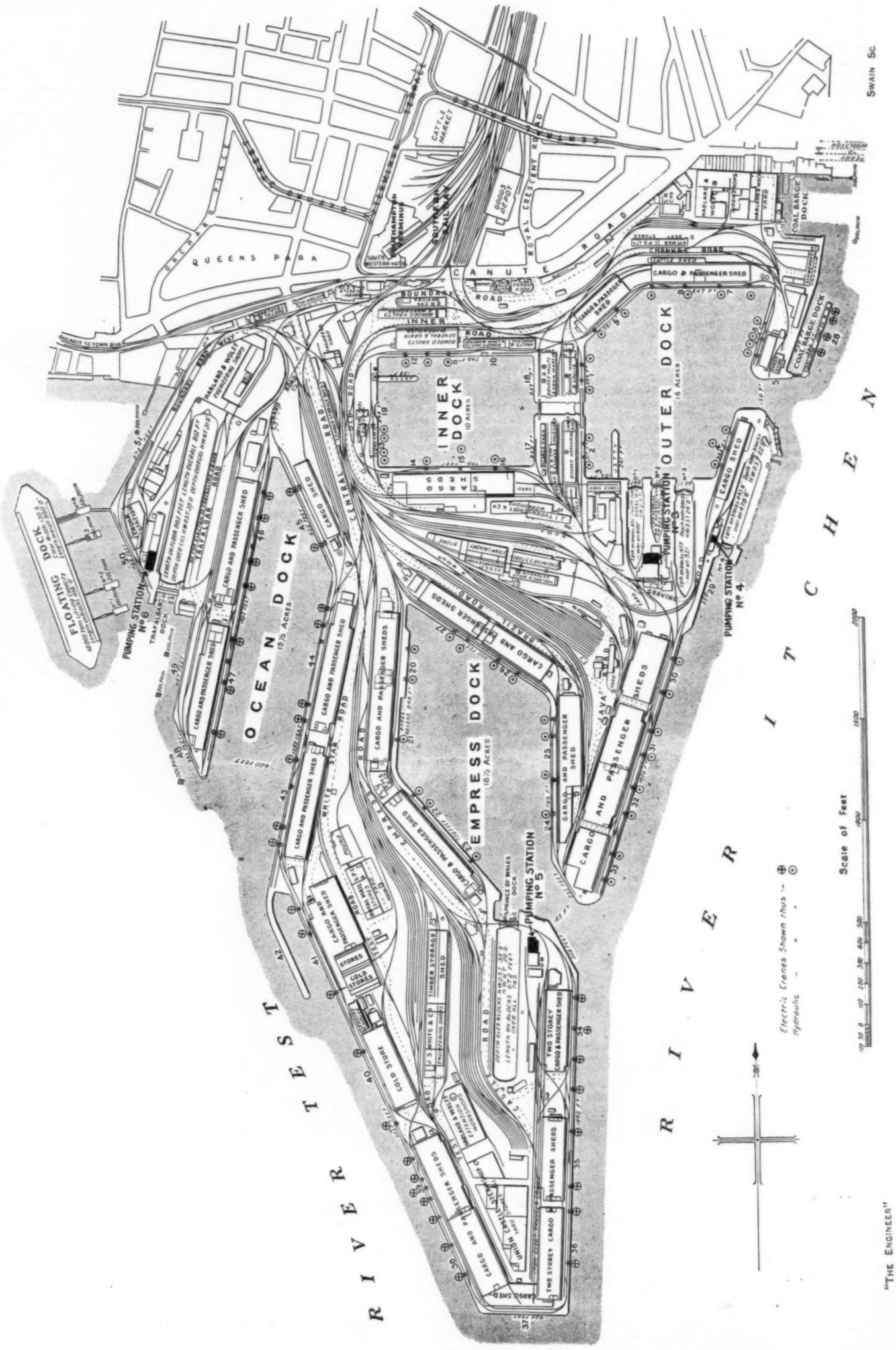
Itchen Quays, Berths Nos. 30-33.—These quays were built in 1875; they were widened and deepened in 1905 and now have a depth of about 30ft. at L.W.O.S.T. They are used as the home terminus of the Canadian Pacific Steamship Company, who carry passengers and cargo to and from Montreal in the summer months, and to Halifax in the winter, when the port of Montreal is blocked with ice. They are also used by vessels of the Rotterdam Lloyd Line which call at Southampton on their way to the Dutch East Indies and on their return.

Empress Dock.—The Empress Dock has a depth of about 26ft. at L.W.O.S.T., and is used by the Royal Mail Steam Packet Company, the oldest shipping company in the world, whose Charter of Incorporation dates from 1839. Among the vessels which the company run to South America are the motor ships "Asturias" and "Alcantara," each having a gross tonnage of 22,000. The company bring home a large quantity of chilled beef, which is dispatched direct to various towns in the United Kingdom. The Empress Dock is also used by H.M. Transports, and during the winter one berth, and sometimes more, are kept busy with the dispatch and reception of troops and military equipment to and from India and the Colonies. In this connection it will be recalled that Southampton was the scene of embarkation for the South African War, and was "Port No. 1" in the last war, when the whole of the docks were devoted to military uses.

* The Institution of Mechanical Engineers.

† 533,723 passengers passed out and home in 1927.

SOUTHAMPTON DOCKS



"THE ENGINEER"

Itchen and Test Quays, Berths Nos. 34–40.—These berths are used chiefly by the Union Castle Company, who make Southampton the home port for their trade to South Africa. They have ten mail steamers and run a weekly service. Besides passengers and mails these vessels carry a large amount of cargo. From Great Britain they take all kinds of case goods and machinery. On their homeward voyages they bring large cargoes of fruit, wool, hides, grain and sugar. The fruit has to be dispatched very quickly. Some of the wool is sent off to the Continent by special steamers. Facing Berth No. 40 is the Cold Store, which will be referred to later.

Ocean Dock.—Opened in 1912, the Ocean Dock is the resort of the largest passenger vessels that traverse the Atlantic Ocean to and from New York. It has a depth of water of 40ft. at L.W.O.S.T., and can accommodate four of the largest liners at one time. It is used by the White Star Line, which runs a weekly service to New York with the "Olympic" (46,439 tons), the "Majestic" (56,511 tons), and the "Homeric" (34,351 tons). The Cunard Company run a similar service with the "Berengaria" (52,226 tons), the "Aquitania" (45,647 tons), and the "Mauretania" (36,696 tons). Since the war, this dock has also been used by the United States Line for various vessels, including the "Leviathan" (59,957 tons). These have been aptly described as floating hotels, but the amount of cargo carried is comparatively small. The vessels call at Cherbourg on both outward and homeward voyages, and it is found that about half the passengers make use of that port in order to travel to and from Paris and the Continent. The north side of the dock is devoted to the unloading and storage of timber.

At the north end of the dock estate are several multi-story warehouses used for the storage of grain, tobacco, and other goods. Most of them contain vaults where wines and spirits are kept in bond. Facing the main road are the shipping offices and commercial buildings. The port accommodation also includes jetties for local and coasting vessels which belong to the Harbour Board, and a number of private wharves, mostly on the Itchen Estuary above the docks.

From this brief summary of the accommodation at the docks and of the shipping companies and vessels which use them, it will be gathered that the traffic is of a varied character. Southampton is essentially a passenger port, and the rapid transhipment of passengers to their destination is always in the forefront of its activities. In the case of a large passenger vessel, however, not only have the passengers themselves to be embarked or disembarked, but their baggage, and stores and fuel for the ship itself have also to be dealt with. The long-voyage vessels carry a fair amount of cargo, and this has to be collected and dispatched by rail, road, and steamer. Again, a port that has facilities for quick transit attracts special traffic that demands rapid handling, such as fruit and chilled meat. Southampton being a terminal port, facilities have also to be offered for survey and repairs to the largest class of vessels. Owing to the large amount of capital represented by a large passenger steamer, the owners of these ships are naturally anxious that their stay in port shall be as short as possible, and all these operations have to be carried out as far as possible simultaneously. The arrangements and equipment have therefore to be of a very simple and flexible character, and those at Southampton have been evolved during an experience of nearly a century.

Approach Channel.—Although the approach channel to the docks is naturally good, the Southampton Harbour Board have done good work in dredging and lighting it. It is now everywhere at least 600ft. wide and 35ft. deep at L.W.O.S.T.

Tidal Quays.—Here it may be remarked that our predecessors were wise in laying out the docks in such a way that practically all vessels can enter or leave their berths without having to pass through locks or wait for tides. To the pilot who has to manœuvre a 50,000-ton vessel, it is an advantage not to have to take her through a lock passage, especially as she has to be attended by half a dozen powerful tugs.

The tidal berth, of course, necessitates the vessel having to lie in some cases in a tideway with a current of 2 to 3 knots, and having to rise and fall the 13ft. of the spring range. This, however, presents no serious inconvenience. Probably the chief drawback of tidal berths is that where the water is still, a certain amount of silting takes place, owing to the fact that a new supply of silt-laden water enters with every tide. But, on the whole, at Southampton, with its moderate range of tide the advantages far outweigh the drawbacks.

Graving Docks.—There are six masonry graving docks varying in length from 280ft. to 912ft. The largest, known as the Trafalgar Dock, was opened in 1905, and in 1912 it was found necessary to widen it in order to accommodate the "Olympic." The entrance is closed by a double-faced sliding caisson, which allows the level of the water to be maintained inside the dock even though the tide is falling outside. A vessel can thus be kept afloat indefinitely if required, as any leakages of water can be replaced by means of a special impounding pump. The pumping station has recently been remodelled and changed from steam to electric power. For dewatering, two 48in. centrifugal pumps are installed, either of which will discharge 450 tons per minute against a varying head of from 0ft. to 37ft. One of these is driven by an alternating-current motor of 1200 B.H.P., running at 231 r.p.m., supplied with current at 6600 volts, three-phase 50-cycles per second. The other is supplied with d.c. current at 480 volts; the motor in this case runs at variable speed from 213 to 245 r.p.m., and this pump is used when slow and intermittent pumping is called for. The impounding pump is designed to discharge 200 tons per minute against a maximum head of 10ft., and is driven by a motor of 350 B.H.P. running at 214 r.p.m. The dewatering pumps were designed to suit inlets and outlets which already existed, and gave some trouble at first owing to the high water velocities involved. These troubles have now been largely overcome. The pumping station also contains a 12in. pump for dealing with soakage water from the dock, priming pumps, and a small sump pump to dry the building itself. The dock is provided with a travelling crane on one side capable of lifting 50 tons from the centre of a vessel within it. No capstans are fitted, as it is found that ships are best hauled in themselves with their own winches. The walls of the dock are provided with the usual altars for the reception of side-shores. But in view of the fact that side-shores have been entirely abandoned for docking large ships on the floating dock, it seems quite likely that the costly process of inserting them will before long be abolished for large ships. Such ships have to be placed on three lines of keel blocks, and this arrangement seems to render side-shores superfluous.

Floating Dock.—The graving dock just described was not quite large enough to accommodate the "Majestic," and in 1924 a floating dock, the largest that has yet been made, was built for the port by Messrs. Sir W. G. Armstrong, Whitworth and Co. It has been fully described elsewhere,‡ and it need only be recalled that it has an overall length of 960ft., an inside width of 130ft., and a lifting capacity of 60,000 tons. On the whole, it has been a success. It was adopted in preference to a masonry dock on the ground that it could be built quicker and (at the time) more cheaply. The saving in first cost has been heavily discounted, however, by the cost and trouble of removing silt from the deep berth in which it lies. This drawback is, of course, incidental to its site and would not necessarily occur elsewhere. Other minor difficulties have arisen. It is perhaps less easy to centre a ship accurately on a floating dock, and although the absence of gates and its great width allow the free admission of light and air, the admission of air when a gale is blowing is rather too free!

Floating Crane.—A floating crane was built by Cowans, Sheldon and Co., of Carlisle, in 1924, to deal with heavy lifts of up to 150 tons. The machinery is all electrically driven, and direct-current at 480 volts is supplied either from shore or from a steam generating set on board. It has three separate hoisting gears, namely, a pair of 75-ton hoists which can be united to lift 150 tons at a maximum radius of 106ft., and a hoist of 40 tons with a maximum radius of 131ft., besides a 10-ton hoist on a trolley travelling along the underside of the jib. Particulars of the motors are as follows:—

	Brake horse-power.	Speed, feet per minute.
75-ton hoists (two)	80	8
40-ton hoist	80	20
10-ton hoist	60	60
Slewing hoists (two)	30	—
Luffing hoists	160	—

The pontoon is 170ft. long and 80ft. wide, and is equipped with electric capstans and an anchor winch. This machine can go alongside the floating dock and lift a 40-ton load from the centre of a vessel on the dock.

Repair Shops.—There are several shops on the dock estate where repairs of all kinds to ships and machinery can be effected. The largest are owned by Messrs. Harland and Wolff, Messrs. John I. Thornycroft and Co., and Messrs. J. Samuel White and Co. In addition, several other firms have shops in the port for building and repairs.

Coaling and Oiling.—At the docks, vessels are provided with fuel at their own berths, so that this operation can be carried on simultaneously with others. The coal is both sea-borne and rail-borne, but mostly the former. For large vessels the coal is in either case brought alongside in barges. Rail-borne coal is transferred to the barges by a balance tip at the coal dock. Sea-borne coal is also transferred here from collier to barge by laying them one on each side of a jetty 360ft. long, on which are mounted four electrically driven 5-ton jib cranes working grab buckets. This plant, which is owned by Messrs. R. and J. H. Rea, can unload a 3000-ton collier in a working day. When a vessel is being bunkered, it is kept about 30ft. away from the quay so that the coal barges can be placed on both sides of it. The coal is filled into baskets which are raised with the aid of whip winches mounted on a special barge alongside and on special wagons on the quay, and discharged into the vessel's side ports. Self-discharging floating elevators are also used.

A large proportion of the big ships now use oil fuel. This is sent alongside in special tank barges by one or other of the oil companies, who have depôts in the port. The barges are placed alongside the vessel and are equipped with pumps to transfer the oil to the ship's bunkers. One of the many advantages of oil fuel is that the vessel need not be boomed off from the quay for bunkering, as oil can be fed in from one side only, thus avoiding interruption to cargo handling.

Lay-out of Sheds and Roads.—In spite of the great increase in the size of vessels during the past eighty years, the lay-out of sheds and roads differs very little from the arrangement first adopted, which was then peculiar to Southampton, but has since been followed at other ports. Usually the space between the cope line and the cargo shed is about 35ft. to 50ft., and is occupied by a quay-crane track and two wagon tracks. The shed itself is 120ft. to 150ft. wide and is usually a single-story building. It contains two wagon tracks, and its floor slopes gently upwards from front to back, so that the wagon track at the back of the shed is "platform high." This greatly facilitates the entraining and detraining of both passengers and cargo. All sheds are equipped with store buildings for landing gear, and offices for Customs, Post and Telegraph, Money Changing, and Working Staffs. The shed equipment includes long tables for examination of baggage, and fencing to direct the movement of passengers. Most of this equipment is portable, so that it can be set up when passengers arrive, and laid aside at other times to give a clear space for cargo movements. Outside the back of the sheds are one or two other rail tracks and a vehicular road by which all road-borne traffic approaches and leaves the sheds. The rail tracks are connected with marshalling grounds, where both inward and outward wagons are sorted, and, if necessary, weighed. The passenger trains run direct from London into the back of a shed, or *vice versâ*, one or more special trains being provided for every important sailing.

Quay Cranes.—It may be that those who visit Southampton Docks form an impression that though cargo-handling machines have been freely introduced, their number is not so great as at some important ports. This is quite a fair statement. But if it be so it is not because the railway company have been disinclined to provide machinery when it was needed. The present equipment is the result of much careful thought, and of many experiments. It will be realised that to deal with the big passenger traffic and the miscellaneous cargo which has been outlined, the handling machinery must be of a very flexible character. For instance, mechanical conveyors in sheds which have been found so useful at certain places, would be worse than useless here because it seems impossible to design a conveyer capable of dealing with all the various size packages which come out of a mail steamer, or of performing the complicated movements necessary, even inside a cargo shed. A conveyor which will not deal with practically the whole of these movements would occupy space far better devoted to storage and to passenger movements. But there are two types of machine which have been found invaluable for quick handling, and which are are so flexible that they do not interfere with movements other than their own. These are the quay crane and the electrically-propelled truck.

A once-famous controversy as to the relative merits of electric and hydraulic quay cranes has perhaps been settled. Many ports, including Southampton, have decided in favour of electric cranes, though the hydraulic crane is still used and has many merits. The hydraulic crane is fool-proof and durable. Some of the hydraulic cranes which were installed in 1893 are still in good order. In cases where cranes are seldom used, or where the rams are not worked to their full stroke, there is, however, trouble due to internal corrosion. There has also been some trouble from the corrosion of mains. This can generally be avoided by laying no mains less than 4in. in diameter, and if possible laying all as ring mains without closed ends. These minor troubles are no doubt due to the fact that the water used for transmitting power at Southampton is salt. The electric crane is also durable, though perhaps not quite so simple as the hydraulic crane. But its great flexibility, and the fact that the same current which supplies it can be used to feed motors of all kinds for use both on shore and on board ship, gives it an undoubted advantage.

Nearly all the berths for larger ships are now equipped with electric cranes. The earliest were built in 1911 by Messrs. Stothert and Pitt, of Bath, for use at the Ocean Dock, where there are a range of six 5-ton and eight 2-ton cranes. They are mounted on high gantries and have a maximum radius of 60ft., which means an outreach from the quay cope line of about 48ft. At this radius the height of the hook above quay level is 60ft., and enough rope is provided on the barrel to lower to 30ft. below quay level. The hoisting speeds are 100ft. per minute for the 5-ton cranes and 200ft. per minute for the 2-ton cranes. These speeds have been found very satisfactory. The cranes are of the free barrel type, which admits of rapid lowering. The power consumption is low, four or five cycles of operation consuming one unit of electricity. Separate motors are installed for slewing and luffing, the latter movement being effected without altering the level of the hook, by means of the "Mitchell-Williams" gear. Direct-current is provided at 480 volts and is fed by a flexible cable from junction boxes placed 40ft. apart on the quay. The cranes travel by hand-gear.

New cranes recently made by the same firm to replace hydraulic cranes on the Itchen and Test Quays differ in some respects from those just described. The radius is greater, generally 86ft., and the rotating portion of the crane is pivoted on a footstool-bearing below the gantry top, instead of resting on a ring of line rollers. The jib is balanced, and the luffing is effected by a bell-crank mechanism so arranged that over-luffing is impossible. The level luffing is effected by the "Toplis" gear. The newer cranes travel by power. A detail of some interest is the design of the track for these large-radius cranes, whose gauge has been fixed at 18ft. All rails have to be sunk flush with the quay, and it is found that the best track is made with a pair of 90 lb. rails similar to those used as "check rails" on the main lines, the crane wheels being provided with centre flanges which run in the groove between them.

Electric Trucks.—For the conveyance of cargo between quay-side and shed, and shed and train, the old-fashioned hand truck is still largely used, and on account of its great flexibility is still the most economical vehicle in many cases. But for certain movements great advantage in speed and cost has been gained by the use of electric-battery propelled trucks. The type adopted at Southampton after many trials is the Ellwell-Parker elevating-platform truck, of 2 tons capacity. The packages to be moved are placed on a wooden table or tray on low legs. The truck then runs its "platform" under the tray, lifts it a few inches off the ground, and carries it to its destination. Here it drops the tray, picks up another which has been unloaded, and returns to its starting point, where it picks up another loaded tray. Thus the truck is never idle. The trucks are propelled by Edison nickel-iron accumulators, charged by means of a five-wire balancer supplied from the 480-volt mains. The charging is done at night and the power thus supplied is sufficient for an eight-hour day. The trucks can be given a boosting charge at midday if longer service is required. They travel at 8 miles per hour, and have a small turning circle.

Other Electric Vehicles.—Battery propulsion is used for lorries which convey odd packages from one shed to another and stores for dock use, two of which are tipping lorries. Electric batteries also operate two small tractors which are most useful for hauling odd wagons, ships' gangways, &c.

Locomotives.—For hauling trains between sheds and the marshalling grounds, and for marshalling, nothing has been found to excel the steam locomotive. The type in general use is the four-wheeled side-tank locomotive with cylinders 16in. diameter and 22in. stroke. It has a 7ft. wheel base, and weighs about 35 tons. The boiler pressure is 140 lb. per square inch, and the tractive force is about 9850 lb.

Wool Conveyors.—Though, as has been said, little machinery is used inside the cargo sheds, mention may be made of a set of three wool conveyors recently erected in a double-story cargo shed at Berth No. 34, by Messrs. Spencer, of Melksham. These convey wool bales between the ground and the upper floor. Each conveyer is of the endless-belt type, and is about 58ft. long and 4ft. wide. It is suspended on a fulcrum at a point about one-third of its length from the upper end, and so balanced that when not in use it can be easily hoisted out of the way, traffic passing beneath. The belt is of rubber-faced canvas provided with heavy slats 4ft. apart, and rests on transverse channel irons supported by two side chains on rollers,

‡ "Proc." Inst. C.E., 1925, Vol. ccxix., pages 211 and 233.

which run on angle iron paths secured to the main plate girders. To prevent shock to these rollers when a bale is thrown on to the belt, a central longitudinal channel is fixed under the transverse channels, which momentarily takes part of the weight if the latter are deflected. The chains and belt are driven by a 5 H.P. reversible motor, fixed in a frame suspended from the upper floor, and running at 750 r.p.m.; by means of gearing it gives a belt speed of 50ft. per minute. This means that the slats pass at the rate of 750 per hour, but the number of bales travelling per hour is, of course, limited by the rate at which they can be fed to the belt and removed. To prevent bales rolling down the belt when descending, a hinged-flap "retarder" is fixed above it near its upper end. This is lifted out of the way when the bales are travelling upwards. The angle of inclination of the belt can be varied so that it is always fed at floor level but discharges a little above floor level. The power consumption is about 2·3 units per hour.

Cold Storage.—On berth No. 40, facing the river Test, are placed the Cold Storage Buildings, which are owned by the International Cold Storage and Ice Company, and have a net storage capacity of 1,200,000 cubic feet. The main building is 400ft. long and 150ft. wide, and contains four floors surmounted by a flat roof partly covered with a receiving shed. Each floor is divided into halves by a central corridor, and subdivided into rooms about 50ft. square by insulated partitions. Access to the corridors, and hence to the rooms, is given by four 30-cwt. cage lifts, which serve all floors and the receiving shed. On the ground floor these lifts serve a long platform alongside a rail siding which runs throughout the length of the building. They also serve a shorter platform at the south end of the building where road vehicles are loaded. Produce can be fed into the building direct from a ship at the berth alongside, by cranes on to the roof, or through chutes on to the basement floor, and by trucks thence to the lifts. Overhead runways are provided on the ground floor on which 10,000 quarters of beef can be hung, and by means of which meat can be run direct to the railway platform with a minimum of handling. A large amount of meat is sent to London in this way packed in containers. On reaching Nine Elms these are transferred to motor lorries and taken at once to market.

Cooling the rooms is effected by the ammonia direct expansion system, except on the first floor, where each room has its own system of forced circulation of dry air, the air being cooled over a battery of ammonia pipes placed in a small chamber. The engine-room adjoining the main building contains a De la Vergne twin vertical double-acting ammonia compressor, 12in. diameter and 20in. stroke, with a capacity of 45 tons of ice in twenty-four hours, and three York single-acting vertical twin compressors 16in. diameter and 20in. stroke, each with a capacity of 70 tons of ice in twenty-four hours. Each set is driven by a compound steam engine. The ammonia condensers are on the flat roof of the building, and consist of coils of 2in. diameter pipe cooled by water which is pumped from the river and, after passing through the steam condensers in the engine-room, returns to the estuary. The engine-room also contains plant for providing electric light and power for working lifts, &c., and a set of valves for controlling the ammonia supply to, and hence the temperature of, each room in the store. An installation of electrical distant-reading thermometers is fitted so that the temperature of any room can be read in the engine-room. Other fittings include steam pressure, temperature, and CO_2 recorders, and a "Lea" recorder for registering the amount of water evaporated by the boilers. Steam is provided by three Babcock and Wilcox boilers, each of an evaporative capacity of 8000 lb. per hour. They are fitted with automatic continuous chain grates and superheaters. Coal is supplied from an overhead bunker containing 315 tons and is fed from ground level by a motor-driven continuous bucket-chain elevator. Arrangements are made for admitting hot ammonia gas into the expansion pipes in the various rooms when it is required to remove the snow from them.

Electric Supply.—Until 1923 the docks were supplied with electricity from a generating station on the estate, where plant with a maximum output of 1600 kW was installed, giving direct-current at 480 volts. This was distributed on the three-wire system. At that time the 60,000-ton floating dock was being built, and arrangements had to be made for an increased supply. It was also decided to increase the number of electric cranes and to electrify the graving dock pumps and other machinery hitherto worked by steam. This necessitated an immediate supply of 3500 kW, and arrangements were made with the Southampton Corporation for bulk supply at high tension. A scheme for its distribution was evolved by Mr. H. Wauchope, the docks electrical engineer, and was described by him in a paper read before the British Association in 1925.* Briefly, the Corporation supply, 6600 volts, three-phase, 50-cycles per second is received at the pumping station of No. 6 Graving Dock. At this point a portion of it is converted to the standard docks voltage of 480, d.c., by means of three 1000 kW rotary converters. The converted current serves the greater part of the dock estate with lighting and power for cranes, workshops, and other purposes, as well as for the floating dock and for one of the large dewatering pumps of No. 6 Graving Dock. High-tension current is also distributed here for working the other two pumps at No. 6 pumping station and to the pumping stations Nos. 3, 4, and 5. At No. 3 station the current is transformed to a voltage of 415, three-phase, to drive a pair of 24in. dewatering pumps which empty any one of three graving docks. It also works a pair of hydraulic-power pumps. At No. 4 station the current is similarly transformed so as to drive another pair of dewatering pumps which empty either of two graving docks. At No. 5 station the same transformation is also effected so as to drive a pair of 48in. dewatering pumps emptying a large graving dock. Here, too, are placed two rotary converters which transform a portion of the current to 480 volts direct-current to drive another set of hydraulic-power pumps, and also to provide light and power for general use at the south end of the dock estate. It may be said that the bulk supply is converted to direct-current for use in cranes, small pumps, lighting, and for general purposes, and is used as alternating-current for the large pumps.

Water and Compressed Air.—A line of water main is laid along all quays and dry docks, with hydrants about 100ft. apart, so that fresh water can be rapidly supplied to vessels alongside. These hydrants are available for fire-exinction purposes if required. When compressed air is required for repair work on board ship, it is usually supplied by the ship-repairing companies by means of portable air compressors which can be placed at any quay or dry dock. These compressors are worked by electric motors, the current being obtained from the docks supply. On the floating dock compressed-air mains are installed for repair purposes.

New Dock Extensions.—A start has been made with a large scheme of dock extensions which is to be carried out on the Western Shore. The scheme involves the reclamation of 407 acres of mudland in the bay of the river Test, about two miles long and extending from the Royal Pier upstream to Millbrook Point. The river face of this reclaimed ground will be for the most part formed by a deep water quay wall, 7400ft. long. Outside the quay wall, the berths and approach channel will be dredged to a width of at least 500ft., and to a depth where necessary of 45ft. at L.W.O.S.T. The soft mud thus dredged will be dumped at sea, but the harder materials will be used to form the reclaimed ground. Facing the quay will be six large cargo sheds, each about 1000ft. long and 120ft. wide, and served by rail tracks and vehicular roads. The site is so arranged that it will be possible in future to construct a jetty about 5000ft. long and 400ft. wide running parallel to the new quay wall and 600ft. away from it. Vessels will be able to berth on both sides of this jetty, and the complete scheme will give accommodation for twenty additional vessels of the largest size. At the upstream end of the reclaimed area a space is reserved for the construction of two large graving docks. Two connections are to be made to the main line. One will be at the upstream or western end of the new reclaimed area, where a siding will leave the main line at Millbrook Station by which passenger and goods trains can be run direct into any of the new sheds, or to a group of marshalling sidings which will be laid down behind them. The other rail connection will be at the downstream or eastern end of the reclaimed area, where a new siding will link up with the Harbour Board's rails at the Royal Pier, and thus connect the new docks with the existing docks. The work involves the reclamation of 116 acres of mudland which belong to the Southampton Corporation, most of which will be returned to them on completion. About 10 acres of this land are to be used as a recreation ground. The work also involves the construction of a new quay wall about 400ft. long, between the Royal Pier and the Town Quay. This will be given to the Southampton Harbour Board for their use, as it will replace the older quay wall which is being used by the new eastern railway approach. As this approach is to pass through the site of the existing Toll House at the entrance to the Royal Pier, this building is to be demolished and rebuilt. The work will include the widening of the vehicular road between the Royal Pier and the Town Quay, which at present is dangerously narrow. Fortunately there are not many buildings along the existing foreshore, as most of it is bounded by the Southern Railway Company's main line from Southampton West to Bournemouth, but such buildings as there are will be cut off from their access to the sea. Among these is the Corporation's electric power station, which at present obtains a large quantity of sea water for condensing purposes from the mudland adjoining, which is covered at every high tide. To meet their requirements, two culverts about 1000 yards in length and 7ft. in diameter are to be constructed from the power station to the edge of the reclaimed area, where they will have their outlets in deep water. These culverts will be used alternatively for supplying and discharging as much as 200 cubic feet of water per second if and when required. A third culvert of the same size is being added to deal with storm water from the town, which at present discharges through various pipes and culverts mainly near the West Station. This culvert will be provided at its outlet with a pumping station which will come into operation during times of very high tide and of excessive rainfall, so as to obviate the flooding which even now sometimes takes place near the West Station, and which otherwise would be aggravated under the new circumstances. The three culverts are to be built in a deep trench, one beneath the other, for the greater portion of their length. The two culverts supplying the electric power station will also be used to supply the Corporation's swimming baths situated adjacent to the power station.

The first portion of the work is now in hand, and involves the construction of 3500ft. of the deep-water quay, together with the reclamation of about half the bay, including the whole of the land belonging to the Southampton Corporation. It also includes the dredging of the berths alongside the new quay wall and of the approach channel to connect them with the existing deep-water channel off the docks, and the construction of the two main railway connections and sufficient sidings to serve the new berths. Three of the cargo and passenger sheds, and the culverts and other incidental works which have been described will be built.

Methods of Reclamation.—Already part of the new channel has been excavated, and about 18 acres of land have been reclaimed with the best of the dredged material. This area was first surrounded by an embankment of dredged gravel which was partly dumped from hopper barges into a cutting dredged through the soft mud, and partly built up by a special transporter, which conveyed the gravel from barges to the upper part of the bank. The seaward face of this embankment was protected by means of fascines, and eventually by stone pitching. Into the enclosure thus formed, gravel, sand, and clay have been filled in by pumping through a long pipe line. The pumping plant was mounted on a special pontoon containing four pumps. Two of these fed water into the barge to be emptied in order to dilute the earth, and the other two, which could be used alternatively or in series, sucked out the earth thus diluted and discharged it through the pipe line on to the ground to be reclaimed. For part of the time two such plants have been in use.

The author has to thank several friends for help in preparing this description of the activities of the port, particularly Mr. E. H. Dashper, the superintending mechanical engineer at the docks; Mr. H. Wauchope, the electrical engineer; and Mr. B. T. Aitken, the manager of the cold store.

* The *Dock and Harbour Authority*, 1925, Vol. vi., pages 27 and 49.

Report on London Waters.

WE have just been favoured with a copy of Sir Alexander Houston's Twenty-second Annual Report to the Metropolitan Water Board on "The Results of the Chemical and Bacteriological Examination of the London Waters." It deals with the twelve months ended December 31st, 1927.

We always look forward with pleasant anticipations to these annual volumes of Sir Alexander. They invariably contain, in addition, of course, to much technical detail and a multitude of statistical tables, some delightfully written narrative or other which may, possibly, have only the very remotest bearing on engineering matters, but which is, unquestionably, very well worth reading. The 1925 volume gave us a history of the New River Undertaking; in that for 1926 there was the tale of the deep wells of Kent; now Sir Alexander tells of the River Lee. As in former cases, the reader is invited to accompany the author on various trips; this time they are into the country north of the Metropolis. The traveller is told of the beauty spots and of the famous people of the past and present, who have lived, or still live, in the districts traversed. He reads of such names as Bulkley, Bunyan, the Carterets, the Howards, Loring, comrade of the Black Prince, Middleton of the "New River," Paxton of Crystal Palace fame, and Izaak Walton, the immortal fisherman. All these and many more had dwelt within the watershed of the Lee, and there can have been few of any outstanding importance whom Sir Alexander has omitted to mention. To complete the charm of the whole, there is a host of excellent engravings reproduced from photographs, almost everyone of which is a work of art.

We are, as we have been with preceding reports, sorely tempted to review the whole account at length, but, as in the past, we resist the temptation, for we are concerned rather with the stern realities of water supply than with the charms of the countryside through which the streams which furnish that supply make their way.

We turn, therefore, though reluctantly, to the more serious—or perhaps we should rather say, more seriously technical—portion of the report, which is divided into eleven sections.

SECTION I.: THE CHLORINATION OF THAMES RIVER WATER.

The first section is concerned with the chlorination of Thames River water. We learn that the average volume of water treated daily—when chlorination is in operation—is 76 million gallons, and that during the year under consideration 19,000,000,000 gallons were treated with a total of 46·09 tons of bleach and 22·02 tons of liquid chlorine. The average "dose," in terms of available chlorine, was 0·46 part per million gallons, and the average cost of chemicals per million gallons worked out at 10·5d. The estimated saving, as compared with what the cost would have been had storage alone been relied upon for purification, was £6883, which was not so much as in the previous year, since the Littleton reservoir became available, and the pumping plant there is more economical to operate than is that at Staines. Still, the saving is very considerable, amounting as it does to 7s. per day for each 25,000 people supplied with water, when chlorination is in operation.

Commenting on the matter, Sir Alexander remarks on the fact that while most excellent results—bacteriologically speaking—have been obtained with chlorination, never since it was started, in May, 1926, have there been any complaints as regards Thames water on the score of "taste." He goes on to remark: "It should be remembered that the chlorination process does not involve loss of storage accommodation. The reservoirs remain full, just as in the past, to guard against periods of drought; the only difference is that instead of pumping Thames river water continually through the reservoirs, at a large cost, the river water, after the almost trivial cost of chlorination, is allowed to gravitate to the beds at Sunbury, Kempton Park, Grand Junction and West Middlesex. . . . The chlorination treatment of the River Thames water, begun as an emergency measure in 1916 to assist the nation during a period of profound difficulty, is still in operation. It supplies an example of what can be done to save large sums of money and actually increase public health security."

CHLORINATION OF THE NEW RIVER.

The chlorination of the New River is, unlike that of Thames water, only carried out during the winter months—say, from the middle of October to the middle of April. The results achieved during the year under consideration are described as being "rather remarkable." Of the 123 samples of water collected at Highfield, upstream of the point where chlorination was effected, 58·5 per cent. contained B. coli in 1 cc. or less. On the other hand, of 122 samples taken at Wood Green—after chlorination—no less than 89·3 per cent. contained *no* B. coli in 100 cc.—or in one hundred times as much water. In short, to use Sir Alexander's own words: "The effects of the winter floods as shown above Highfield, before chlorination, are practically effaced, in a bacteriological sense, by the chlorination at that

station, so that when the water reaches Wood Green it is literally transformed in quality."

Sir Alexander, however, draws attention to a peculiar circumstance. Although at the outlet from the Hornsey reservoir the results were, he says, fractionally better than even those experienced at Wood Green—that is to say, that *no* B. coli were found in 100 c.c. in 91 per cent. of the 123 samples examined—the results at the outlet from the Stoke Newington Reservoirs were far from being as good. In only 21·9 per cent. of the 123 samples examined were *no* B. coli found in 100 c.c. This, Sir Alexander explains, is no new feature, but he is still puzzled to account for it. Do birds, fish or other forms of life account for the discrepancy? Is it conceivable, as some have hinted, that chlorination dopes, but does not kill, B. coli, and that apparently dead B. coli may gradually recover their vitality? he asks, but adds that laboratory experiments do not support that hypothesis.

Pre-filtration Waters.

In his seventeenth Annual Report, Sir Alexander suggested that Londoners really drank lake water. It is true, he admits, that the forty-nine lakes—including Littleton—are artificial, and are called storage reservoirs, and, further, that they are fed from sources which are not free from considerable criticism. "Nevertheless, if the hand of man had played no part in their construction, and if, instead of being separated, they had been united to form one vast sheet of water, covering over 2700 acres and holding nearly 20,000 million gallons, the impression of security thus created would have been of a very material kind. The writer ventures to suggest that such a feeling of safety is not misplaced under existing conditions, as the policy of the Water Board is definitely in favour of the equalisation of storage, so far as this is reasonably practicable." One method of showing how much better the stored waters are is, continues the report, to take some of the positive B. coli percentages in the raw waters and contrast them with the relative volumes of stored water yielding somewhat similar percentages. For example, the raw Thames river water contained B. coli in 50 per cent. of the samples in 0·1 c.c. or less. Now, as the Lambeth—Molesey—stored water contained B. coli in 100 c.c. in only 39·1 per cent. of the samples, it may be said that, on this basis, the Molesey stored water was improved over 1000 times. "It is impossible," goes on the report, "to store river water without certain physical and chemical changes taking place, and it is possible to read into these alterations of composition, indirect, but valuable evidence of what has taken place bacteriologically; for it takes time to effect these physical and chemical changes, just as it requires time for the destruction of pathogenic bacteria in water under conditions of storage. It is by no means solely a case of reduction, but rather one of altered ratios. For example, the ammoniacal nitrogen, turbidity and colour tests show a greater percentage reduction—especially the first two—than the albuminoid nitrogen and permanganate tests."

Barn Elms Experiments.

Filter bed No. 18 at the Barn Elms works was, some time ago, altered so as to permit of the flow through it to be increased to three or more times the customary "London rate," which is rather less than 2 gallons per square foot per hour. The bed is fed from waters from rapid filters working at the rate of 134 gallons per square foot per hour. The chief questions which it was sought to answer were:—

(1) Would the filtrate from No. 18 bed compare favourably or unfavourably with the filtered waters generally, as judged physically, chemically and bacteriologically?

(2) Would there be an increase or a decrease in "the number of million gallons filtered per acre cleaned"?

(3) Would there be any evidence of a gradual but progressive blocking of the interior of the filters, resulting in "the number of million gallons filtered per acre cleaned" becoming less and less as time went on?

With regard to these questions, the report states that, as the result of forty months' experience—including all the periods dealt with in last year's reports—it would seem that the following results can be obtained, assuming comparable conditions by the methods employed at Barn Elms:—

(1) A final product practically as good, on the average, as that resulting from the ordinary slow sand filtration process.

(2) Comparative freedom from algal troubles, or those caused by an excess of suspended matters, owing to the useful work carried out by the primary filters.

(3) A much greater output per acre of filtration area, allowing for the space covered by the primary filters, per unit of time.

Furthermore, as concerns any evidence of gradual but progressive blocking of the interior of the filter, resulting in the "number of million gallons filtered per acre cleaned" becoming less and less as time goes on, no progressive interior choking of filter bed No. 18 would seem to be foreshadowed. During one of the "runs," 335·4 million gallons were filtered between successive cleanings.

Walton Works.

Our readers will remember that, comparatively recently, rapid primary filters were installed at the Walton station of the Board, the purpose being to pass water from the Walton reservoirs through these primary filters and afterwards through ordinary sand filters at higher rates than is usual. The object, of course, is to filter a greater quantity of water in a given area. There are eighteen primary filters working at an average rate of 119·7 gallons per square foot per hour. The rate of flow through the secondary filters is 5·1 gallons per square foot per hour, which is in the neighbourhood of three times the ordinary flow. The final filtrate is chlorinated.

During the period covered by the report the percentage number of samples of raw river water which contained no B. coli in 100 c.c. was 0·4, and 82·9 per cent. of the samples contained B. coli in 1 c.c. or less. In the average final filtrate as supplied to the mains 96·4 per cent. of the samples yielded no B. coli in 100 c.c. This result, Sir Alexander remarks, is a striking feat and bacteriologically, would be difficult to surpass, and he adds:—"When it is remembered that there were no taste troubles, that the temperature of the *raw* water varied from 0·0 deg. Cent. to 20·0 deg. Cent., and the oxygen absorbed from permanganate in 3 hours at 80 deg. Fah. fluctuated from 0·095 to 1·192, the success of the treatment can only be described as wonderful."

Yet, all was not quite well at Walton. The report states that "it must be admitted frankly that the chemical results, divorced from their bacterial 'settings,' were disappointing. The sand in the primary and secondary filters did not seem to acquire a good protective film. How far this was due to the novel methods of working, or lack of maturity and of consolidation of the materials of the filters, or to some quality of the stored water, or to some unrecognised factor it is difficult to say. It is quite certain, however, that about October–November—at all events—the Walton stored water was in a most remarkable state."

The experiment was tried of reducing the rate of filtration on one of the primary beds from 100 to 50, and also of reducing the rate on one of the secondary filters from 4·59 to 2 gallons per square foot per hour. As judged by colour, that had practically no effect, so filtration through a Berkfeld filter was tried in the laboratory. The result was, as nearly as may be, the same, which showed that the colour in the Walton stored water was largely in colloidal solution and could not be removed by ordinary filtration processes, but that it required some special treatment to alter its character completely.

The results led to the carrying out of some interesting experiments at Walton. A temporary sulphate of alumina "dosing" apparatus was installed in connection with one of the primary filters. The dose varied from 1·25 to 5 parts per 100,000, and the relatively satisfactory percentage reductions of colour from 36 up to 50 were obtained. Even when a dose of 5 parts per 100,000 was employed for only one hour, a not unsatisfactory, although diminishing, reduction of colour, which lasted for several days, occurred.

"There can," remarks Sir Alexander, "be no reasonable doubt that, if the same set of conditions arose in subsequent years, and if it were considered expedient to improve the colour and chemical results generally, the use of a coagulant, in doses by no means economically unpracticable, would remedy matters."

Some interesting laboratory experiments were carried out to determine how far damp fallen leaves, added to tap water in the proportion of 1 per cent. and allowed to infuse for 24 hours, would affect the colour results. The remarkably sodden condition of the ground, during a great portion of the year, should not, remarks the report, be overlooked in this connection. The following results were obtained:—

	Colour.
Control	30
+ Beach leaves	240
+ Oak leaves	640
+ Elm leaves	1000
+ Horse chestnut leaves	1280
+ Sycamore leaves	2400

It is not suggested, continues the report, that these figures actually convey a true picture of the relative colouring powers of the leaves from the trees specified. They were "chance" experiments, but "viewed from any standpoint they were certainly illuminating."

In conclusion, Sir Alexander thinks that though, under the novel conditions prevailing at Walton, it may be difficult to supply a perfect water on physical and chemical grounds, judged bacteriologically, and assuming the continuance of sterilisation processes, the water would almost certainly conform to the highest standards of purity and safety. That the secondary filters would be able, between successive cleanings, to deal with phenomenal quantities of water—an average of 445 million gallons—seems, he thinks, to be reasonably assured.

The remainder of the report can be briefly summarised. Section VI. is devoted to "Resistance to Filtration and Microscopical Appearances of the Pre-filtration Waters." In Section VII. are given "Meteorological Notes," which are interesting though somewhat gloomy reading. Section VIII. deals with "Non-sporing Aerobic 'Lactose-Negative' Microbes"; Section IX. with "Search for Pathogenic Microbes in Water"; and Section X. with "Suspended Solids in Thames River Water and in Walton Stored Water." In Section XI., under the heading "Miscellaneous," the following subjects are discussed:—"Green Growths in New River Water"; "Leptospira in Water"; "Excess Lime Method"; "Typhoid Fever"; "The Question of Accident"; "Visitors, Health Weeks, Lectures," &c.

SIXTY YEARS AGO.

On the afternoon of Thursday, June 25th, 1868, the then recently formed Aeronautical Society opened its exhibition of aeronautical equipment at the Crystal Palace, London. In our issue of the following day we published some preliminary comments on the exhibits, and gave in full a catalogue of them. The catalogue described eight entries of light engines, two complete sets of "aerial working apparatus," sixteen models of balloons, aerostats, &c., fourteen working models, twenty-one plans and drawings and nine kites, "or other similar apparatus proposed to be used in cases of shipwreck, traction or in the attainment of other useful ends." Among the light engines were (*a*) a 1 horse-power engine weighing about 60 lb., of which the motive power was derived from gun-cotton; (*b*) a 1 horse-power "turbine injector steam engine with inclined vanes," weighing less than 12 lb.; (*c*) a ½ horse-power engine and boiler, oil fired, by J. Stringfellow, working at 100 lb. pressure and weighing, with two 3ft. propellers and the water and fuel, 16½ lb.; (*d*) a 1 horse-power copper boiler and "fireplace," also by Stringfellow, weighing about 48 lb., and capable of sustaining a pressure of 500 lb.; (*e*) an aluminium steam engine by Viscount de Pouton d'Amecourt; and (*f*) a working model of an internal combustion oil engine by Dr. F. J. Money, of Brighton. One of the sets of "complete working aerial apparatus," was Charles Spencer's flying machine for attachment to the body. The catalogue stated that with a less perfect force of this apparatus, the inventor had accomplished a flight of 160ft. rising from the ground by a preparatory running action. It was evidently—and no doubt very wisely—thought necessary to add a note which would prepare visitors to the exhibition for a disappointment if they expected to see this performance repeated. Some delay, it was stated, might occur in adapting the idea and discovering the best form of construction. Among the working models was one of an aerial steam carriage by Stringfellow. This model was, because it made use of steam, not allowed by the manager of the Crystal Palace Company to be flown inside the main building, and had to be demonstrated by attaching it to a travelling pulley on a line. In our preliminary comments on the exhibition we said that a very considerable proportion of the exhibits manifested a painful ignorance of first principles, and in many instances a marked deficiency in mechanical thought or aptitude. We emphasised the importance of devising a light form of engine, and described Mr. Stringfellow's as that most nearly approaching a practical form. We also commended his use of three superimposed "aereo planes," on Mr. Wenham's plan, as a means of obtaining support, and held that "the principle of propelling a wide short plane through the air" would be that which would be successful, if any ever was, in attaining mechanical flight. Mr. Spencer, we noted, had not yet appeared on the scene.

BRITISH WATERWORKS ASSOCIATION.

The seventeenth annual general meeting and Conference of the British Waterworks Association is to be held at Manchester from July 4th to 7th next.

The following programme has been arranged:—

On Wednesday, July 4th, at 11 a.m., there will be a meeting of the Executive Committee in the Town Hall, and at 1 p.m. the members of the Committee will be entertained at luncheon at the invitation of Sir Edward Holt, Bart. In the afternoon at 2.15, the general meeting will be begun in the Large Hall of the Town Hall. After the transaction of the usual business, the incoming President will be installed and deliver an address. The following paper will then be read and discussed:—"Waterworks and their Financial Relations with the Community," by Maurice H. Munro, Accountant, Manchester Corporation Waterworks Committee. In the evening at seven o'clock there will be a reception at the Midland Hotel by the President, Alderman Sir Edward Holt, Bart., Chairman of the Manchester Waterworks Committee, after which there will be the annual dinner.

On the Thursday at 10 a.m. the following papers will be read and discussed:—"The Underground Distribution and Thickness of the Secondary Formations in England, with Special Reference to the Sources of Subterranean Water," by Edgar Morton, Lecturer in Engineering Geology, University of Manchester, and "The Heaton Park Service Reservoir," by Samuel Hall, A.M. Inst. C.E., resident engineer. Luncheon at the invitation of the Waterworks Committee will be taken at the Town Hall at 1 p.m. In the afternoon visits will be paid to Lostock booster station and Heaton Park reservoir, and in the evening at 7.30 p.m. the Lord Mayor will hold a reception.

For the Friday, July 6th, an all-day visit to Haweswater works has been arranged. Members will meet at Victoria Station, Manchester, at 8.50 a.m.

For the Saturday, arrangements have been made for visits to places of local interest.

Tenders are to be invited for the dredging of the channel of the Rio Valdivia, in Chile. It is proposed also to construct a number of concrete warehouses, wharves, &c., and to build a new port on a site about six miles south of the town of Valdivia. Application will be made to Congress during the coming session for funds to construct a broad highway between Valdivia and Ozorno, passing through the town of La Union.

11,000-VOLT ELECTRIC TRANSMISSION LINES IN SCOTLAND

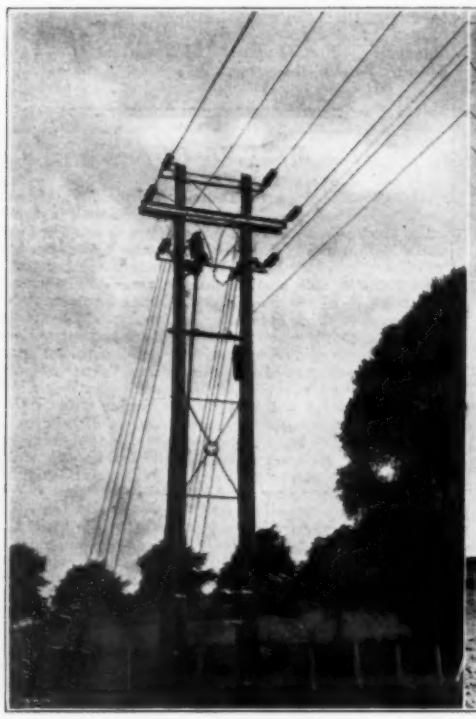


FIG. 1—TERMINAL ⊏ POLE

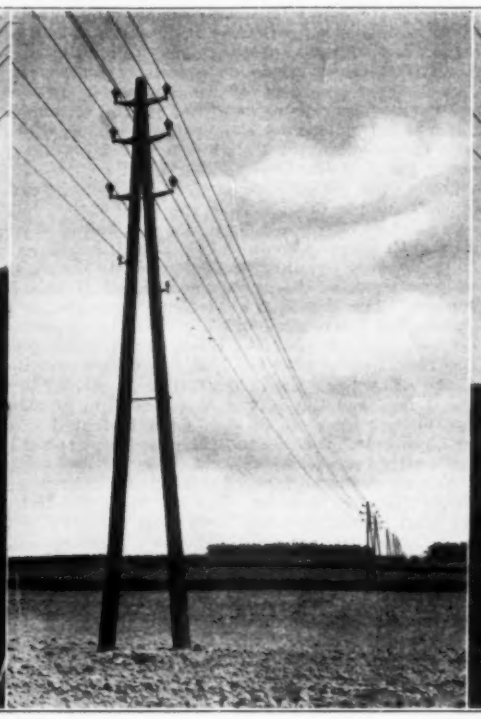


FIG. 2—STRAIGHT RUN OF LINE

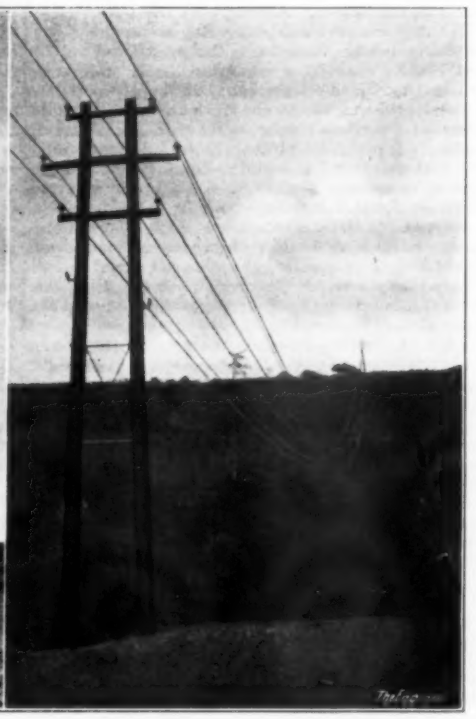


FIG. 3—H-POLE FOR 135-YARD SPAN

Institution of Electrical Engineers.

SUMMER MEETING.

No. I.

FOR the second time within a period of six years the Institution of Electrical Engineers is holding its summer meeting in Scotland. The last occasion on which this annual affair took place in that quarter was in 1922, when Mr. J. S. Highfield, was President. Originally it was proposed that, this year, a visit should be paid to Norway, but apparently the idea did not meet with adequate support, and the visit was abandoned. The party assembled in Glasgow last Monday, and on the following morning proceeded by motor coach to the University, where there was a reception in the main drawing hall of the Engineering Department by the Lord Provost of Glasgow, Sir David Mason, and the Principal of the University, Sir Donald MacAlister. Subsequently the Falls of Clyde Hydro-Electric Works of the Clyde Valley Electric Power Company were visited. Luncheon and tea were provided by the company. At 4.30 p.m. or therabouts the party returned to Glasgow, and at 8.45 p.m. attended a conversazione and dance at the Central Station Hotel. The Stonebyres and Bonnington Hydro-electric Stations were described in our issues of September 30th and October 7th and 14th, 1927, and we scarcely need deal with them here, but the 11,000-volt overhead lines associated with those stations are worthy of attention. There are three main feeders:—(*a*) A six conductor feeder, run mainly overhead, which links the Wishaw section of the Clyde Valley Electrical Power Company with the Bonnington hydro-electric station. Each conductor has a cross-section of 0·15 square inch, and protection is carried out on the split conductor system. (*b*) A feeder between the Motherwell Steam Station and the Stonebyres Hydro-electric Station. This consists of six conductors of 0·2 square inch cross-section. The greater part of the route is covered by the overhead line, but there is a short length of 0·2 square inch three-core cable at each end. The split conductor system of protection has been adopted. (c) A feeder linking the Motherwell Station with the Stonebyres Station *via* Larkhall. This is a six conductor 0·15 square inch feeder, similar to that linking the Wishaw section of the Clyde Valley Electric Power Company with the Bonnington Station. Between the two hydro-electric stations there are two three-conductor feeders, each of 0·2 square inch cross-section. These two feeders are protected by Merz-Price gear.

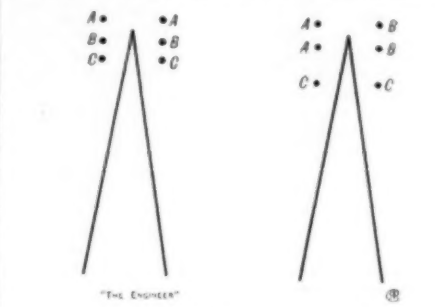


FIG. 4

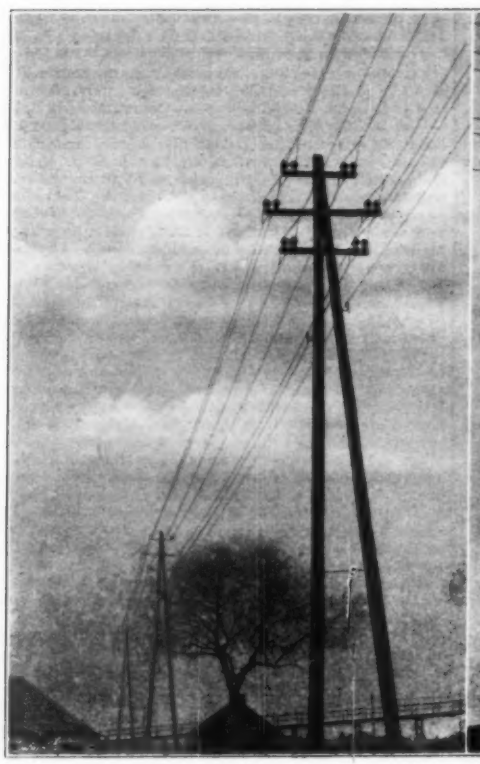


FIG. 5—STANDARD ROAD CROSSING

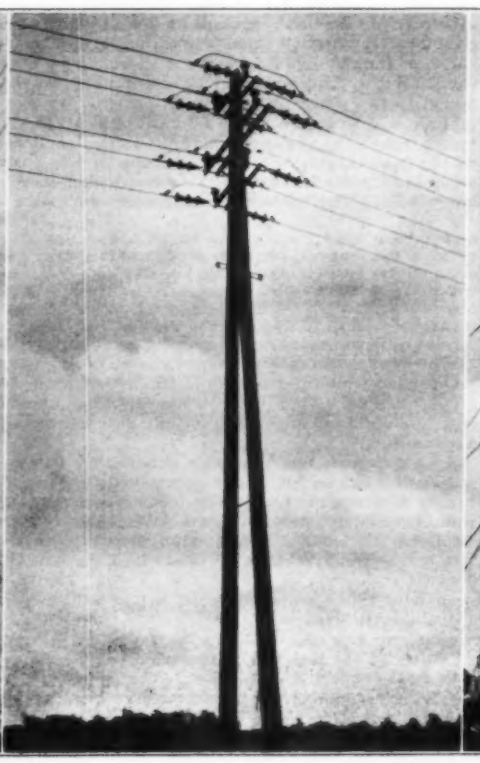


FIG. 6—POLE FOR STRAIGHT SECTION OF LINE

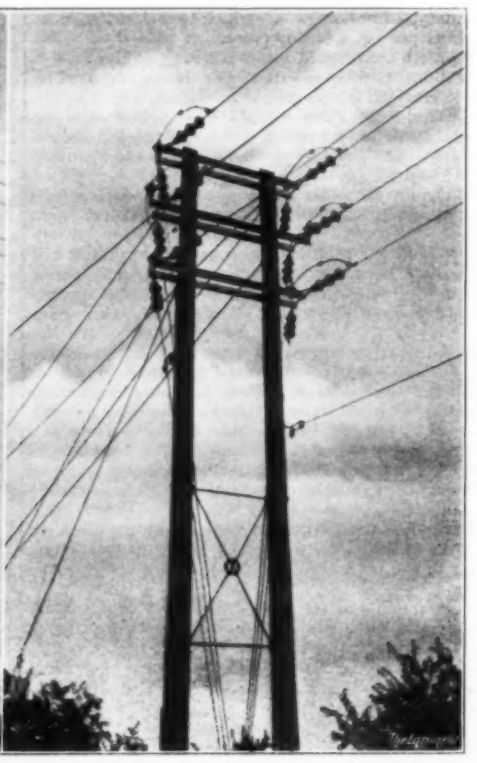


FIG. 7—SECTION AND ANGLE POLE

The overhead lines were constructed by R. M. Russell, of Glasgow, in accordance with the supply company's standard E.H.T. overhead line arrangement. For the purpose of regulation, boosters supplied by the English Electric Company are installed at each end of the feeders. They are each rated at 336 kVA at 0·7 power factor, the line current being 444 ampères, and the boost 755 volts. The periodicity is 25 cycles per second. Each booster has five tappings, giving a total boost of 755 volts in both directions—that is to say, up or down. A similar set of three single-phase boosters is provided at the Motherwell end of the line, so that the line can be regulated at both ends. Two standard three-core paper insulated lead-covered and double steel taped armoured cables are run from the power stations to a terminal pole—as shown in Fig. 1—and the line then runs across country on poles shown in Fig. 2, where it will be noted that the upper horns on the poles are more closely spaced than the middle and bottom pairs of horns. This construction is the result of a peculiar type of fault which was met with immediately the first lines were put into service. The line phases on the poles were arranged at that time—as shown on the left of Fig. 4—where it will be seen that the phases were in the order A, B, C on both sides of the pole. This brought the conductors of the same phase in the same horizontal plane, but conductors in the vertical plane were of opposite phase. With this arrangement it was found that when crows, perched on the line, were startled, and rose from the lower phase to the higher phase in a flurried mass, they sometimes caused a short circuit between phases, the wings of two birds making connection between two of the wires. In order to overcome this trouble it became necessary to alter the arrangement of the phases in accordance with the scheme shown on the right of Fig. 4. The middle horns were raised so as to reduce the clearance between the top and middle pair of horns, and to increase that between the middle and bottom pair. The phases on the left side of the pole were also arranged in the order A, A, C, and on the right hand side of the pole in the order B, B, C. The new arrangement gives a very much reduced vertical clearance between conductors of similar phase and a considerable increase in the clearance between the C phase conductors and the A and B phase conductors above them on the centre pair of horns. Since the adoption of this arrangement no bird trouble has been experienced.

FIG. 8—TYPICAL OUT-DOOR SUB-STATION

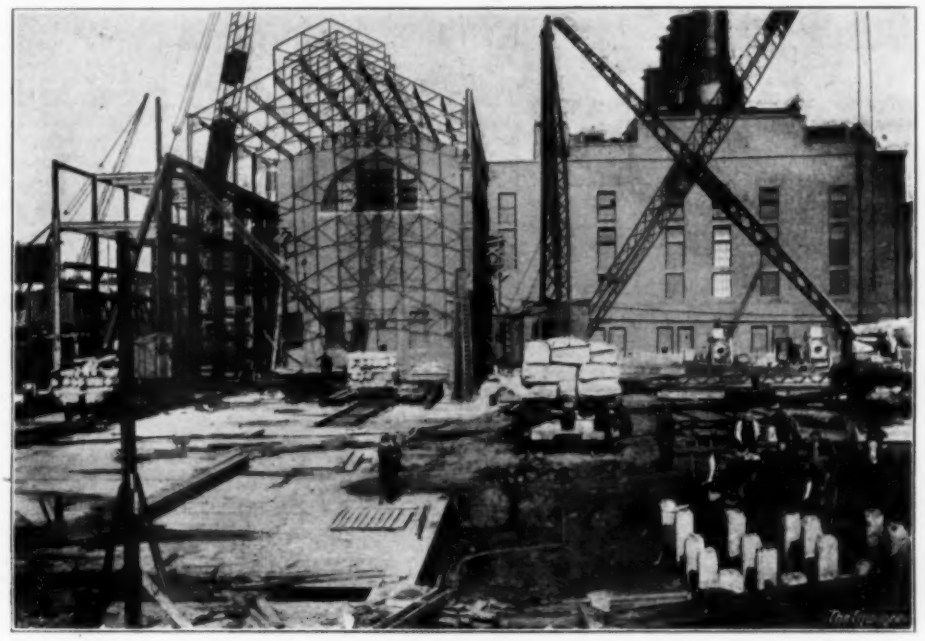


FIG. 10—PORTOBELLO STATION EXTENSION

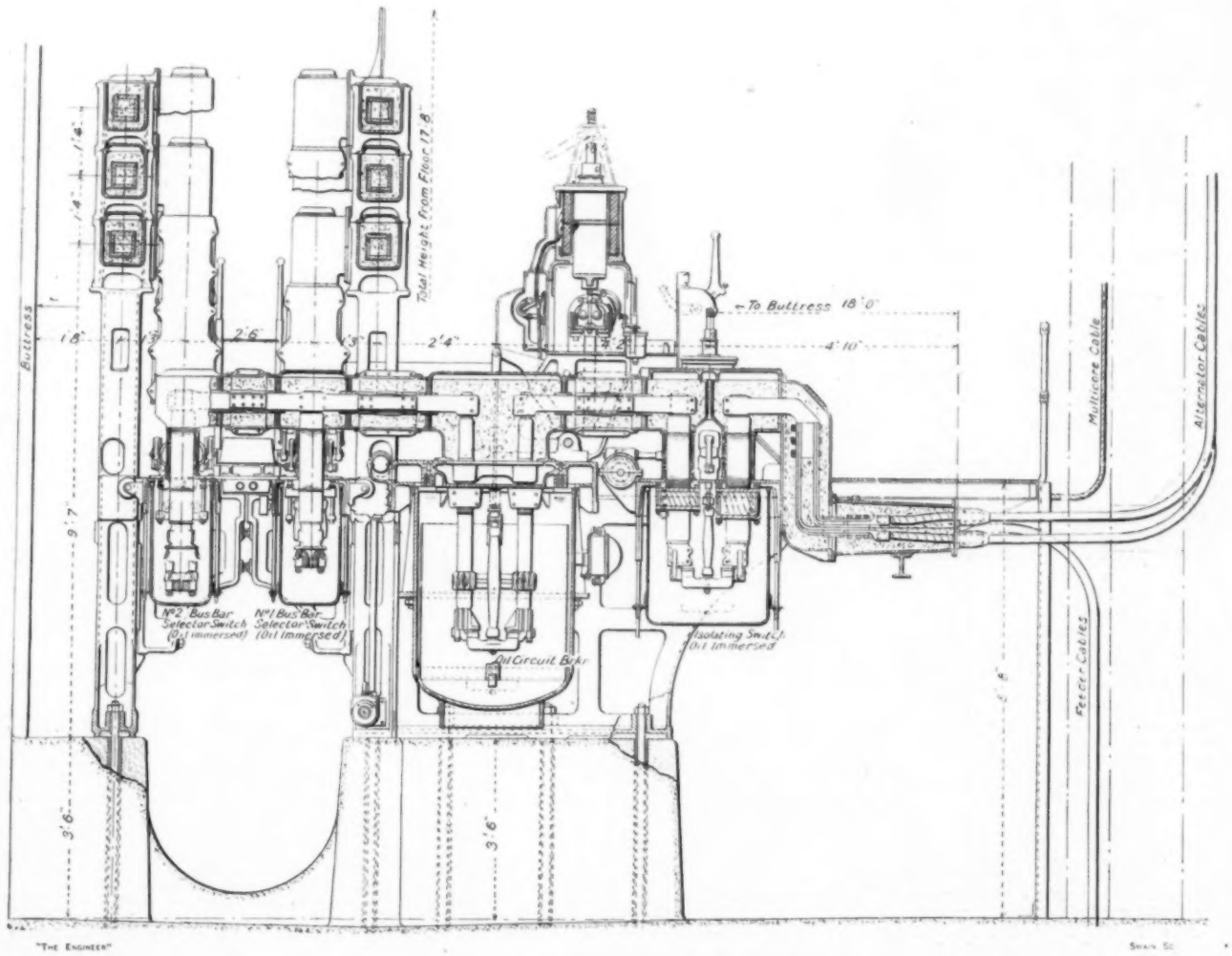


FIG. 9—MAIN COMPOUND-FILLED SWITCHGEAR

The illustration—Fig. 3—shows a H hole on a span of 135 yards across a ravine, and Fig. 5 a standard form of construction for road crossings. Each conductor is in this case duplicated over the whole span length, and two insulators are provided at each pole. Throughout the span the duplicate conductors are bound together at intervals. Fig. 6 illustrates the A pole form of construction on a straight line section where the conductors are terminated on a string of three suspension type insulators; whilst Fig. 7 illustrated a section and angle pole. It is sometimes necessary to tap lines of this type for rural supplies, and Fig. 8 shows a typical outdoor sub-station of 50 kW capacity. When erecting these sub-stations it is only necessary to make the main line dead for about half an hour, in order to connect the three jumpers between the main line and the air-break outdoor type switchgear fitted on the top of the sub-station pole. To the left of the pole are the conductors of a three-phase four-wire L.T. line which were carried some distance to give a rural supply.

On Wednesday morning the party left for Edinburgh, arriving at 11.15 a.m. The first item on the programme was a visit to the Portobello power station of the Edinburgh Corporation. Some of the members, however, paid a visit to Holyrood Palace, the Castle, the National War Memorial, and other places of historic interest, reaching the North British Station Hotel, together with the members who inspected the Portobello power station, in time for luncheon.

The Portobello power station was opened by the King on July 11th, 1923. At that time there were three Brown-Boveri turbo generators, each rated at 12,500 kW. Two years later a 12,500-kW Metropolitan-Vickers machine was added. Subsequently a 5000-kW set, provided with a new Parsons turbine, was transferred to Portobello from one of the Corporation's other stations, thus bringing the total capacity up to 55,000 kW M.C.R. The two most recent sets run at 3000 revolutions per minute; those that were installed earlier at 1500 revolutions per

FIG. 11—CIRCULATING WATER PIPES

minute. For the most part the auxiliaries associated with the condensing plant are steam turbine driven, although for the last two sets duplicate electrically driven pumps have been provided.

There were originally six tri-drum Stirling boilers having superposed economisers, but two additional boilers with economisers were installed in 1925. The total heating surface of each of the eight boilers, exclusive of the economiser and superheater surface, is 10,350 square feet; the normal full-load evaporative capacity of each unit 65,000 lb. per hour and the overload capacity 80,000 lb. per hour. The working pressure is 300 lb. per square inch and the steam is superheated to a temperature of 700 deg. Fah. at the stop valve. The specified pressure and temperature at the turbine stop valve are 290 lb. per square inch and 690 deg. Fah. respectively. Coal, which for the most part consists of washed pearls with a calorific value of 10,500 B.Th.U., is supplied to the station from the Lothian Collieries, which are within a radius of about 6 miles. The sidings are on the L. and N.E. Railway Company's system, and on a site about 800ft. from the boiler-house. Trucks are passed over a weighbridge on to a rotary tippler supplied by the Mitchell Conveyor Company. It gravitates into a hopper having a capacity of about 50 tons, from which it falls on to a belt conveyor about 706ft. long and passes through a tunnel 430ft. long below two roads and a railway. The main conveyor discharges into hoppers which feed two bucket elevators made by Fraser and Chalmers.

From the estuary of the Forth the condensing water is drawn through three tunnels 57in. in diameter. Each tunnel is 500 yards long and terminates in a shaft of 9ft. in diameter. Suction and discharge bus pipes are connected between the land shafts in such a manner that each may be used for the discharge water in turn, thus reversing the flow, and this method of circulation has proved effective in the way of preventing the growth of mussels in the culverts. There are four pumps, each having a capacity of 14,000 gallons of water per minute against a total head of 50ft.

In 1926 the Electricity Commissioners gave permission for the Portobello station to be extended, and these extensions—see Figs. 10 and 11—are now in hand. Two new Brown-Boveri sets, each with a maximum continuous output of 31,250 kW and designed for a speed of 15,000 revolutions per minute, are on order. Twin condensers for each set and duplicate extraction pumps are being supplied by W. H. Allen, Sons and Co., Ltd. Four additional Stirling boilers of the same capacity as those already in service, but fitted with air heaters and grit arresters, are under construction and another four will shortly be ordered. There will thus eventually be sixteen boilers in all with an evaporative capacity of 1·32 million pounds per hour. Extensions to the coal sidings and conveying plant will permit of unloading at the rate of up to 120 wagons per day, representing approximately 1000 tons of coal. The pump house is being extended to enable it to accommodate three new pumps.

The main compound-filled switchgear—see Fig. 9—associated with the extensions will be of new design, and it is being supplied by the Metropolitan-Vickers Electrical Company. Each switch will have a breaking capacity of 1,500,000 kVA. The weight of each unit complete with the oil will be 31 tons. The busbar selector switches, as well as the isolating switches, will be oil immersed and operated electrically from the control board. Normally, the duplicate sets of busbars will be coupled together through reactances. It is believed that these metal-clad units will be the largest so far manufactured. The alternator circuit breakers have been designed to carry 3500 ampères at 6600 volts.

During the year ending May 15th, 1928, the Edinburgh electricity undertaking sold 101,714,000 units. The maximum load was 48,400 kW. In accordance with the supplementary particulars of the Central Scottish scheme, prepared by the Electricity Commissioners, the Portobello station is required to produce 337,500,000 units in 1930–1931 with a maximum demand of 100,750 kW. In the year following 378,600,000 units are expected to be sold, and it is anticipated that the maximum demand will reach 112,500 kW. The present extensions at Portobello will bring the total maximum rating of the station up to 117,500 kW and an additional set will eventually increase the capacity of the station up to 150,000 kW.

(To be continued.)

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

MULTIPLICATION WITH A DIFFERENCE.

SIR,—In the letter I addressed to you last week and which you reproduced on page 695 of the issue of 22nd inst., there are two errors in the figures.

The product of 15,273 by 161 should be 2,458,953 instead of 1,771,668, which is the product of 15,273 by 116.

The second error is more obvious. The final figure in the example, 123 by 456, should be 56,088.

Needless to say, I greatly regret that I did not notice the former mistake before signing my previous letter.

London, E.C. 2, June 26th. C. PLENDERLEITH.

OVERHEAD *VERSUS* UNDERGROUND CABLES.

SIR,—Your leading article on this subject is really rather courageous (!), in view of the generally accepted belief of most people that overhead lines are about three times as cheap as underground cables.

This was the figure given by Mr. Page—in his presidential address at the I.E.E.—as his reason for deciding in favour of overhead lines, and it was, of course, a perfectly sound one and sufficiently convincing.

The truth is that when we want to transmit only small powers the overhead line is vastly the cheaper; but as we get to greater and greater powers there is a distinct tendency to approach equality.

It is a question whether, in view of the tendency to generate greater and greater powers, it would not be the better policy to put down a system capable of transmitting the largest powers likely to be required for, say, the next twenty years; otherwise—if a ten years' forecast be considered sufficient—it is necessary to debit the conducting portion of the line, including insulators, with sinking fund charges based on the shorter "life"—or increased expenditure—which would tend towards the equalisation of underground and overhead charges.

In the writer's opinion, the 132,000-volt single-core cables, which have now been in operation for nearly a year at Newark, U.S.A., will—if they emerge satisfactorily from this test—be the solution, and he is prepared to show that, on a basis of 133,000 kW, the cost of transmission by these cables, operated under his latest proposals, works out materially less than with overhead lines; or, by adopting "intersheath" cables, the power could be reduced to 100,000 kW and yet maintain the same saving over the overhead system.

Alternatively, if 185,000 kW were transmitted the saving over the overhead system would be of the order of 50 per cent.—intersheath cables considered.

It should be added that on the score of reliability the 132,000-volt cables put down by Pirelli at New York and Chicago would, of course, be the most suitable of all, but their cost is rather prohibitive at present. However, under the writer's proposals this would perhaps be halved per kilowatt transmitted, but even then the overhead system would be the cheaper.

With regard to the limit of 100,000 kW which Mr. Page has set for his system, counting the two halves of the ring main as each of 50,000 kW, is it not worth while considering that in time of war or civil strife a complete generating station may be temporarily put out of commission, and might not the section of the line in such a case be called on to transmit 100,000 or even 200,000 kW?

A. M. TAYLOR, Major, S.O. 2.

Birmingham, June 23rd.

PORT AND STARBOARD.

SIR,—In the current number of your journal, page 675, column 3, line 9, there appears to be a misuse of the word "helm," which I should not have noticed had it not been italicised. The word "helm" reminded me of the sea jingle:—

> "When both side lights you see ahead,
> Port your helm and show your red."

To make sure I looked the word out in the big Oxford Dictionary and found:—

> "Helm, the handle or tiller by which the rudder is managed. . . . Down with the helm, Down helm, the order to place the helm so as to bring the rudder to windward."

It would appear thus that the word "rudder" was intended in place of "helm" in the paragraph.

I have never been able to find the sea jingles in any book, but in case they may interest you I add those that precede and follow the one I have quoted:—

> "If to your starboard red appear
> It is your duty to keep clear:
> To act as judgment gives as proper,
> 'Ease her!' 'Go astern,' or 'Stop her.'
> But when upon your port is seen
> A steamer's starboard light of green,
> There's not so much for you to do,
> For green to port keeps clear of you."
>
> "When in safety or in doubt
> Always keep a good look out."

Probably you know more of them than I do. The large French Larousse Dictionary confirms the change from *bâbord* and *tribord* to *gauche* and *droit;* from tiller orders to direction orders or rudder movement.

Acton, W. 3, June 23rd. L. A. LEGROS.

[We thank our correspondent for calling our attention to our misuse of the word "helm." It should undoubtedly have been "rudder." Regarding the sea jingles to which Mr. Legros refers, it may interest others besides himself to know that they were written by Mr. Thomas Gray, Assistant Secretary, Board of Trade, and appeared in our issue of November 1st, 1867. The verses were marked "Copyright." We reproduce them below in the exact form in which we originally printed them:—

STEERING AND SAILING RULES.

AIDS TO MEMORY, IN RHYME.

By THOMAS GRAY, Assistant Secretary, Board of Trade.

Two Steam Ships Meeting.

Meeting steamers do not dread.
When you see three lights ahead—
Port your helm, and show your RED.

Two Steam Ships Passing.

GREEN to GREEN—or, RED to RED.
Perfect safety—Go ahead!

Two Steam Ships Crossing.

If to your Starboard RED appear,
It is your duty to keep clear;
To act as judgment says is proper—
To Port—or Starboard—Back—or, Stop her!
But when upon your Port is seen
A Steamer's Starboard light of GREEN,
There's not so much for you to do,
The GREEN light must keep clear of you.

General Caution.

Both in safety and in doubt
Always keep a good look out;
In danger, with no room to turn,
Ease her!—Stop her!—Go astern!]

AGRICULTURAL ENGINEERS

ON Wednesday last we had the pleasure of visiting the works, at Bedford, of J. and F. Howard, Ltd., on the occasion of the reception of the British Empire farmers by the firm. Most of our readers, of course, appreciate the fact that the firm is active in several directions, and we have occasionally described machines coming from the Bedford works which can hardly be described as agricultural. Nevertheless, we were rather surprised at the diversity of the machinery now going through the shops, which includes ballast dredgers, parts of cement-making plant, petrol locomotives, conveying machinery, ropeway and other light structural work. Incidentally, the occasion was made the opportunity of demonstrating the firm's road grading and scarifying machines, hauled by tractors of the allied firms of Agricultural and General Engineers. At our request, one of the graders was put to the test of levelling out a piece of rough virgin grass land, and although the space available, together with the obstacles on the site, did not give the machine a really good chance, it was obvious that it was capable of substantiating the claims of the makers, and is in several ways superior to its American prototypes. As to the tractors, rollers, &c., which we saw at work, there is no need to make detailed references, as they are quite familiar to our readers.

Railway Matters.

AT a meeting of the Railway Rates Tribunal on June 18th, the Chairman, Mr. W. B. Clode, K.C., was congratulated on the knighthood conferred on him in the Birthday Honours.

AT the close of the proceedings on Wednesday, June 13th, of the joint select committee which is inquiring into the Bills for giving road transport powers to the railway companies, the chairman said they were getting into a serious position. If the Bills were passed they would have to be before the House by July 12th, which left only seventeen working days, including those for discussing clauses. It would be a very great scandal if these Bills were dropped because they had not been got through in time.

THE Institution of Railway Signal Engineers had its Summer Meeting on Friday and Saturday, June 22nd and 23rd. As the President for the current year, Mr. W. S. Every, is the signal engineer of the London Electric Railways, it was appropriate that the gathering should be in London. The places visited were the signalling school of the London Electric Railways, the Post Office Railway and the automatic signalling installation between Bow-road and Barking on the London, Midland and Scottish Railway.

WE regret to have to record a serious railway collision, which took place 300 yards to the south of Darlington Station shortly before midnight on Wednesday last, June 27th. A heavy ten-coach excursion train from Scarborough to Newcastle, drawn by an "Atlantic" type engine, collided with the engine and one van of the Newcastle to London parcels express, which had left Darlington Station for shunting purposes. Two coaches of the excursion train were telescoped, with the loss of twenty-two lives and injury to many passengers. An official inquiry into the accident is being held.

ANSWERING a recent question by Commander Kenworthy as to large orders for material for the Indian railways being placed with foreign firms, Earl Winterton said that by an agreement with the Indian Government, entered into, not by the present British Government, but by one of its predecessors, it was agreed that all orders, or practically all, for State requirements in India should be open to the lowest tender, i.e., to firms abroad and at home. There had been great criticism of that system at different times, and it had been suggested in some quarters that it was a bias against British firms; equally, in the Assembly, it was alleged to be a bias against foreign firms. Neither criticism was in the least justified. The only way in which British firms could compete successfully with foreign firms was by lowering their prices.

THE failure of a driver, who was taking his engine into the shed, to appreciate that his movement would jeopardise the men turning their engine on the adjoining table, led to the fireman of the latter engine being crushed, with fatal results. Mr. Scott Main, who inquired into the accident, blamed the first-named man, but said that the importance of the signalling equipment had lapsed through disuse owing to indifferent operation and general intention. For the purpose of guarding against possible contact while engines are being turned on the table and engines entering or leaving the shed, the table is provided with a lock which, when withdrawn by lever, is supposed to operate two ground disc signals as an indication that movement into or out of the shed must not be made while the turntable is in use and the disc signals are at "danger." Owing to indifferent operation and lack of proper equipment, these signals have not been observed, and for a considerable time they appear to have been disregarded.

WITH reference to the article on the summer train services in France, which appeared in our issue of June 15th, our attention has been drawn by Monsieur E. Sommier, of Paris, to the fact that we omitted to mention the fastest train of all. He informs us that the "Rapide"—train No. 185—on the Nord between Paris and St. Quentin, is booked to run the 153·2 kiloms. between those two places in 1 h. 32 min., or at the rate of 99·9 kiloms.—nearly 62·08 miles—per hour. The fastest booked train in France is not, therefore, the "Sud-Express" between Bordeaux and Dax, a distance of 147·5 kiloms., which is timed to accomplish the journey in 1 h. 29 min., or at the rate of 61·95 miles per hour. Monsieur Sommier has also kindly sent to us a reprint of an article from his pen which was published in the issue for June 22nd of our contemporary *La Journée Industrielle*, and which was accompanied by an informative and detailed list giving particulars of upwards of 225 fast trains in France. In each case there are given (*a*) the number of the train; (*b*) the places between which the run is made; (*c*) the distance in kilometres; (*d*) the booked time in hours and minutes; and (*e*) the line to which the train belongs. In addition, in those cases in which electric traction is employed, that fact is notified.

BEHIND the announcement, mentioned in our Seven-Day Journal on June 22nd, that the London, Midland and Scottish Company is about to spend a large sum of money on its Tilbury and Southend section, there lie many negotiations which are now probably forgotten. One of the conditions, for instance, under which the Midland Company acquired that line in 1912 was that before 1914 the latter was to come to Parliament for powers to convert the line between Fenchurch-street and Southend from steam operation to electric traction and to complete the work within seven years. Under its Act of 1914 the limit within which those powers were to be sought was extended until 1916. No such powers have as yet been asked for. The latter Act also sanctioned a new line east of Stepney, which would not only double the accommodation, but render it unnecessary to run over what was then the Great Eastern between Stepney East Junction and Gas Factory Junction. The four lines of way between Campbell-road Junction and Barking were to be continued as far as Upminster, a further 7¾ miles. All that has, as yet, been done on that line is the provision of automatic signalling between the end of the Metropolitan District Railway and Barking. The work now being carried out at Tilbury is part of the scheme for making that place a big passenger and cargo port for cross-Channel and overseas trade. The scope of the undertaking there has been mentioned in our last two annual reviews of engineering on railways.

Notes and Memoranda.

AN unusual application of chromium worth mentioning is the plating of files to be used for cutting soft metals. One firm which treats its files in this manner has found that the metal being filed does not clog up the file teeth as it does on untreated files; moreover, their useful life is greatly increased.

IN a letter to the *American Machinist*, the British Aluminium Company says:—"We believe that the usual method of removing grease or oil from motor vehicle parts is by dissolving it in paraffin or kerosene. If, however, it is desired to neutralise the oil by means of caustic soda this can be done with safety on aluminium by adding a few per cent. of water glass which stops any action of the metal."

ONE of the characteristics of chromium is, according to Mr. S. H. Bailey in the *American Machinist*, that such metals and alloys as lead, tin, zinc, brass and babbitt do not adhere to it readily. A chromium-plated part can be immersed in a molten bath of one of these metals and when taken out will be perfectly clean. This fact would seem to warrant the hope that, in the near future, crank shafts and similar parts will be plated, as the tendency for the journals to "freeze" would be remote.

IN the summary of a paper read before the Institution of Engineers and Shipbuilders in Scotland, Mr. R. M. Brown says:—"That when a material has been cold worked to such an extent that plastic flow has taken place, the internal stresses are due to the elastic recovery of the material, and are, therefore, not proportional to the amount of cold work done. The stresses increase as the elastic recovery increases, and lesser degrees of cold working, therefore, appear to give higher internal stresses. A research of greatly extended scope is being undertaken to investigate the question more fully.

A REPORT issued by the Dominion Statistical Department shows continued progress in the telephone development of Canada. During the past ten years the total number of instruments in use has increased by 116 per cent., while, in addition to the Bell Telephone Company of Canada and the three provincial systems of Manitoba, Saskatchewan and Alberta, 2479 smaller systems are worked by private municipal and co-operative companies. On January 1st, 1927, there were 1,201,000 instruments in Canada, representing an annual increase of 58,132 and a density of 128 telephones per 1000 population.

THE Geological Survey of Canada, in view of the extensive use of electrical prospecting in the mining industry, has commissioned Messrs. J. B. Mawdsley and L. Gilchrist to make an investigation of the conditions under which the various methods and apparatus now in use can be successfully employed. These methods appear to be available in locating mineral bodies where the ordinary prospecting methods are not applicable. While different processes are in use there has not been time to ascertain their comparative advantages, and it is hoped that some data of practical value will result from this investigation, which will be mainly carried on in the Rouyn mining field of Quebec.

THE cost of a trial boring for a tube well on the North-Western Railway of India, varies, according to a recent official report, a great deal, according to the strata encountered, the depth drilled, and the type of pipes used. In strata of sand and of soft clay the gross cost per foot up to a depth of 200ft. has worked out as low as 2 Rs. per 1ft. with flush joint, and swelled and cressed pipes. Such a boring carried down to a depth of 350ft. should not cost more than 3-8-0 Rs. per 1ft. These figures include the cost of withdrawing the casing pipes. In strata of hard clay and kunkur with only occasional shallow layers of sand, the cost may work up to two to three times the figures given above.

IN a note in the *Industrial Australian* it is stated that efforts are being made by the Melbourne Tramways Board to minimise the noise of electric trams in the city, and various experiments are being conducted by the Board's engineers. Discussing this subject, the chairman said that while an entirely noiseless tram was an impossibility, Melbourne's trams were no more noisy than those in other parts of the world. Various factors combined to make noisy conditions, many of them inseparable from tramway operation. Perhaps the most frequent cause, Mr. Cameron said, was corrugation of rails, which occurred suddenly, and could not be prevented. Within three or four months a rail-planing machine which the Board was having built locally would be completed, and would be used to keep the rails smooth. Another maker of noise was a "flat" on a wheel, caused by the wheel sliding on a slippery rail, which, although almost invisible, made a noise like a sledge hammer when the tram was running. The solid tracks which the Board was legally compelled to build were noisier than open ballast tracks, and at times noise was caused by "drumming" of the sides of the trams. Everything possible was being done to reduce noise due to these causes.

DURING the past year the Engineer's Department of the R.A.C. has employed, with considerable success, the microscope and photo-micography for the examination of any parts of cars and motor cycles that have failed. As a result, it has been possible (*a*) to fix definitely in a large number of cases the actual cause of failure of driving shafts, steering arms, connecting-rods and many other parts, and, in addition, this scientific examination has been utilised for the following purposes; (*b*) to inquire into the condition of such parts as front axle beams, the safety of which, being dependent on correct heat treatment, is often impaired as a result of unskilled straightening following an accident; (*c*) to find the cause of failure of case-hardened parts through wrong case hardening of welded parts; (*d*) to inquire into the quality of joints made with aluminium solder and to obtain information as to the cause of failure of white metal bearings. In addition to the above cases, it has been successfully used to prove the existence of foreign matter in the oil of a large six-cylinder engine, which had suffered considerable damage thereby; to ascertain the thickness of silver and nickel plate on certain plated articles; and to discover how many coats of paint had been applied to a surface.

Miscellanea.

THE Norwegian State Railways have purchased 90,000 tons of Spitzbergen coal at the price of kr. 17 per ton c.i.f.

IT is proposed to construct a 180ft. dam to regulate the outflow from Flathead Lake, near Butte, Mont., and to develop 148,000 horse-power.

THE double bascule bridge over the Welland Ship Canal, on the highway between St. Catharines and Niagara Falls, was opened informally for traffic on June 1st.

THREE new furnaces have been erected at the works of the Stanton Ironworks Company, Ltd., near Nottingham. They will have an output of 1000 tons of pig iron a week.

THE Ontario Government has made a grant of 50,000 dollars to Queen's University for a new combined chemical and mining building. This is in addition to the yearly grant of 300,000 dollars.

THERE will be an important section devoted to fuel economy at the Colliery and General Mining Exhibition, which is to be held in the City Hall, Deansgate, Manchester, from July 10th to 21st.

ACCORDING to a statement made by the Hon. E. E. Charteris before the Joint Parliamentary Committee which is considering the Railway Companies' Road Transport Bills, to reconstruct a road to-day, in order to make it suitable for motor traffic, costs £12,000 a mile.

THE West Riding of Yorkshire Regional Smoke Abatement Committee is convinced that low temperature carbonisation has now reached a state of development where solid smokeless fuel can be produced commercially at a price which, having regard to bulk and thermal efficiency, is such as to make it an adequate and economical substitute for coal.

WHAT is claimed to be the largest floating factory in the world has just been completed at a German yard for a French company. It is to be used in connection with the Newfoundland fisheries, and is of 1540 tons displacement. Mechanical devices are used for beheading and gutting the fish and the offal is made up into fish meal. Over a thousand fish can be dealt with hourly.

WORK was officially started on June 4th on the Detroit-Windsor vehicular tunnel, which involves the digging of a trench 50ft. deep and 150ft. wide beneath the river to receive the steel tubes. The estimated cost of the tunnel, which is to be completed in two years, is 28,000,000 dollars. The steel tubes are being supplied by the Canadian Bridge Company, of Walkerville, which obtained the contract in competition with about twenty Canadian and American firms.

Two seams of high-grade bituminous coal are reported to have been discovered at Little Forks, about seven miles from Springhill, Nova Scotia. The discovery, which is said to be one of the richest made in Nova Scotia for many years, consists of two seams of excellent coal. The overlying seam, about 35ft. below the surface, is slightly more than 3ft. in thickness. About 30ft. below it, and with good rock between, is the other seam, which is 5ft. in thickness.

MINING for gold ore is now being carried on at the Village Deep, Transvaal, at a depth of 7300ft. The conveyance of men and material to and from such depths is in itself a big undertaking. It is effected in three stages. The first is No. 3 vertical shaft, which connects with the eighteenth level at a depth of 4000ft.; the second is the main incline shaft, which follows the dip of the reef to the thirty-third level, an incline distance of approximately 4000ft., to a vertical depth of slightly more than 6200ft.; whilst the east and west sub-incline shafts constitute the third stage.

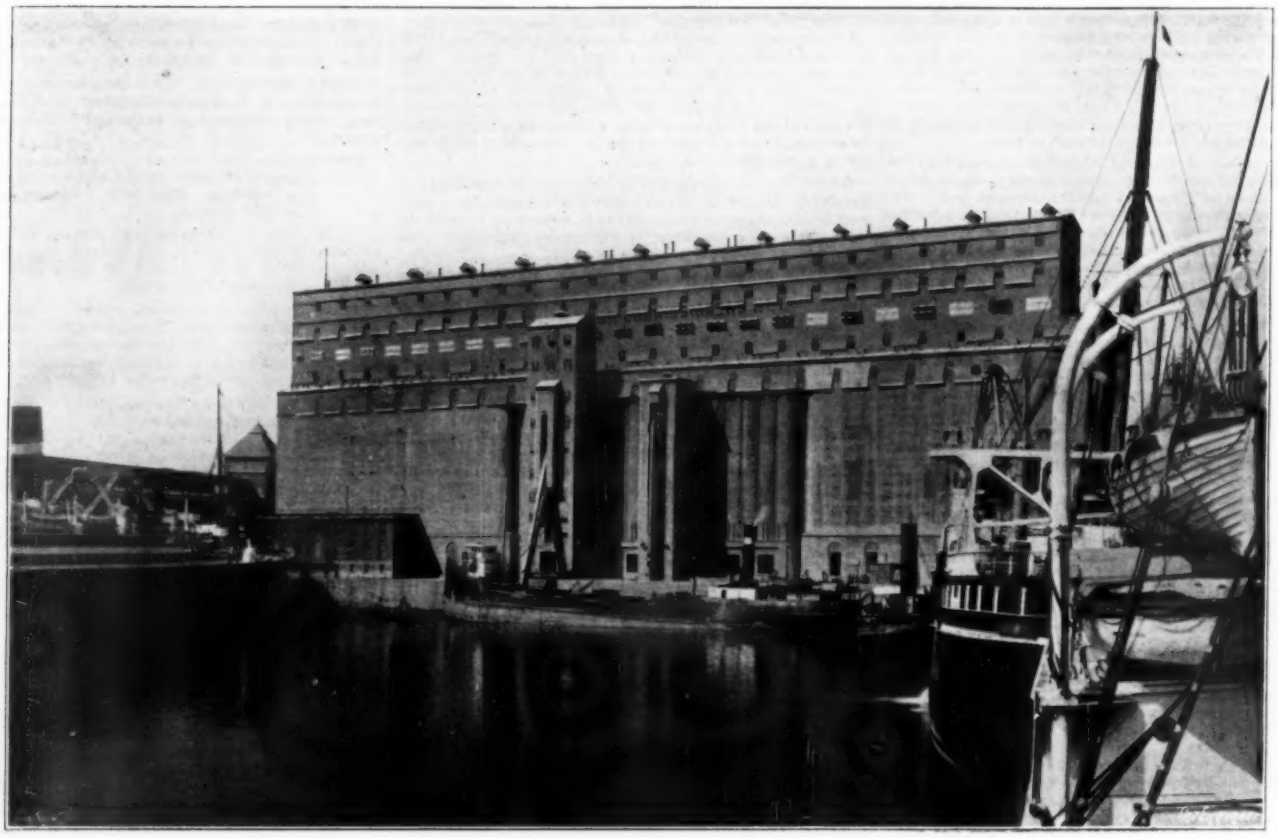
ON October 1st of this year, Gatineau Power Company will commence deliveries of electric power under two contracts to the Hydro-Electric Power Commission of Ontario. The first contract calls for annually increasing quantities of power until October 1st, 1931, when the fixed maximum demand will be 260,000 horse-power, and the total yearly kilowatt-hours to be delivered approximately 1,190,000,000. Under the second contract an additional 100,000 horse-power is reserved for the Commission, which agrees to take at least 60,000 horse-power. This power is to be taken in minimum annual increments of 6000 horse-power for ten years, beginning October 1st. The Commission will take the balance of the 100,000 horse-power during the ten years as far as needed.

TWENTY-THREE engineering students from Cambridge University are to make round trips to New York and back as extra engineers in Cunard Liners during the vacation. They will travel in connection with a scheme, arranged by the Faculty of Engineering at Cambridge and the Cunard Line, to provide practical experience for engineering students. Some students are leaving Southampton on Saturday in the "Mauretania" and "Caronia," while some are going in the "Laconia" from Liverpool. During the voyage they will take watches in the ordinary course of their duty, and in every other respect be treated like the engineer officers in the steamer. Every facility will be given for them to receive instruction and advice from the regular sea-going engineers. Other students will follow in Cunarders until the middle of September.

THE first meeting of the committee appointed to study the matter of the installation of a plant for the distillation of coal in Chile took place on April 30th. Reference was made at the meeting to the financial assistance to be given by the Government for the installation of a plant for the manufacture of metallurgical coke and liquid combustibles, oils and coal products. According to the respective law, 10,000,000 dollars of the loan to be raised for the development of the coal industry can be used for this purpose, and an interest of 8 per cent. is guaranteed on capital invested therein up to the sum of 20,000,000 dollars. The result of the discussions was that further samples of Chilean coal should be dispatched to Europe, United States of America and Japan for the purpose of determining which process will be most suitable for reducing Chilean coal to coke and producing combustible oils. It was also definitely decided that the experiment should be made on the basis of the low carbonisation process.

GRAIN ELEVATOR EQUIPMENT AT MONTREAL

(*For description see page* 717)



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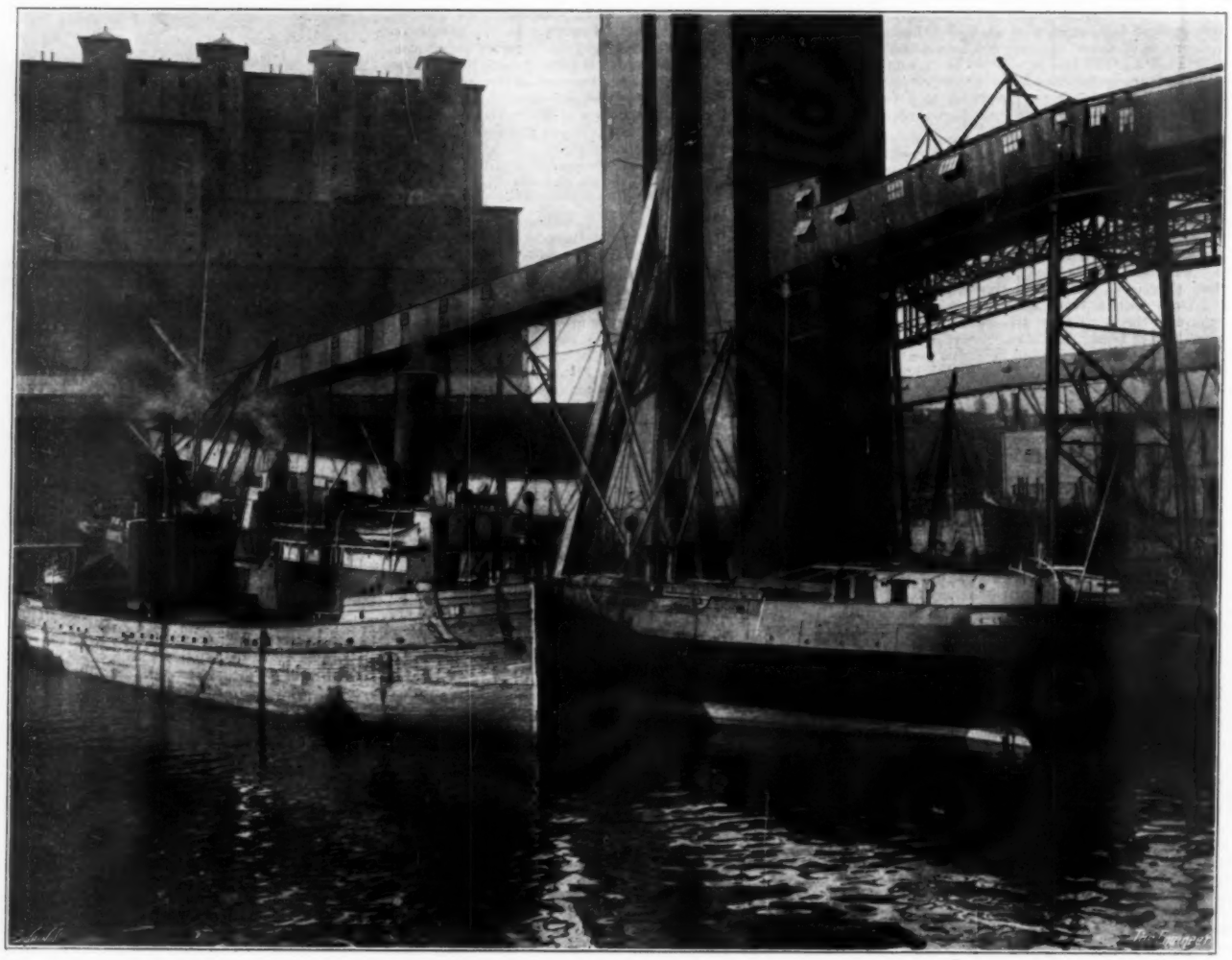

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SIXTEEN-PAGE SUPPLEMENT—"THE METALLURGIST."

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The Metallurgist.

THE JUNE NUMBER OF THE MONTHLY METALLURGICAL SUPPLEMENT TO "THE ENGINEER" ACCOMPANIES THIS ISSUE.

DEATH.

On June 26th, at Island House, Chiswick Mall, W.4, LEONARD MILNE, M. Inst. C.E., aged 69.

THE ENGINEER.

JUNE 29, 1928.

Architecture and the Engineer.

UNDER the censorious title "The Decline and Fall of Civil Engineering," Mr. A. Trystan Edwards contributes to a recent number of the *Architect* an article which he calls "Some Reflections on the Centenary of the Institution of Civil Engineers." As a matter of fact, it has little or nothing whatever to do with that event, save that it takes the mind back to the works of the great engineers of one hundred years ago. The text of Mr. Edwards' argument may be given most conveniently in his own words: "At the time when the science of engineering made its greatest strides . . . the great practitioners always remembered that they were not only constructors but artists, and, in fact, would have been insulted if their claim to this latter title had been seriously impugned. That was the golden age of engineering. Are the precious standards of value which then prevailed to be lost sight of in modern practice, or will it once more be possible to achieve that spiritual marriage between art and engineering which produced in the early nineteenth century such masterpieces of design as Waterloo and London bridges, the dignified lighthouses and dockyard buildings which still bear witness to British genius in design? Do modern engineers wish to create beautiful forms, or have they imbibed a fatal doctrine that if only they construct rightly they already achieve beauty, or yet another equally objectionable doctrine that it is not necessary for them to achieve beauty because art is a luxury . . . ?"

The "golden age of engineering" to which Mr. Edwards refers was one of the most remarkable periods through which Great Britain has passed. The Napoleonic Wars were but recently at an end and a heavily taxed country seized with avidity the chances of rapid recovery which were offered by the extension of industrialism. The factory system advanced at a pace which social organisation could not maintain, whilst the sudden development of railways, fostering the feverish haste for prosperity, added to the general confusion. Material progress was so rapid, the overthrow of old-established customs was so complete, the conversion from an aristocracy of landowners to an aristocracy of factory owners and middlemen, was so unexpected that the country had no time to reorganise its ideas and accommodate itself to the new conditions. In these circumstances it is not surprising that violent anomalies existed. On the one side the old traditions inspired the execution of works, admirable alike for their restraint, their harmony, and their grandeur, whilst, on the other, the mean and sordid houses of the poor and of the lower middle-class reflected the views of factory owners and merchants who knew no traditions and recognised no social obligations to those over whom they exercised an almost uncontrolled despotism. In the hundred years which have elapsed since that initial period, society has accommodated itself to the industrial environment. Most of the violent anomalies have gone; the bottom and the top, one with great ideas and the other with mean ideas, have merged, with the familiar result—the formation of a mediocrity. The poorest modern street is less removed from the palaces of Park-lane than Nash's Regent-street was from the hovels of Birmingham or Manchester a hundred years ago. The upward movement of the lower classes has given influence to a large proportion of the population bred up without any traditions of art, whilst with the descent of the upper classes, from the secluded Olympus in which they lived, to the market place, much of the old traditions of grandeur and dignity have been surrendered to commercial considerations. The result as a whole is, as we have said, an inevitable mediocrity. It is that mediocrity which is the cause of the decline in the artistic level of engineering products to which Mr. Edwards refers. Those works of the civil engineers which are akin to architecture suffer, just as architecture does, from the lack of a definite clear-cut inspiration. The religious emotion which moved the builders, masters or workmen, of the great cathedrals, and which might still be found in the works of civil engineers up to a hundred years ago, has gone. The architect or engineer no longer builds great bridges to the glory of God, but only for "the use and convenience of man." Not yet can the heights of art be attained with that as the sole motive. Every great work of the past was an act of worship; the grandeur which they possess is akin to that of Paradise Lost. It was inspired by a feeling of devotion that is foreign to the present age. Without that emotion, or, let us say, without something as yet unknown which may replace it, the world will not cry out for great artistic productions, and the civil engineer will not be able to design them. A country with a "Woolworth's" mind will get what it merits. "Efficiency" is now the demand, and efficiency cramps the style of the artist. The Hungerford Bridge at Charing Cross is completely efficient, the Lambeth Suspension Bridge is completely efficient, the elevations of great theatres and shops are only not completely efficient because they do not provide a sufficient area of flat surfaces for the display of advertisement; the architect struggles to make them beautiful, forgetting that the owner will disfigure them with sprawling placards which cover up or destroy the effects that he had sought to produce. The doctrine of big business has run amok in the artistic emotions. The engineer might design a beautiful factory chimney, but it would inevitably be used to support illuminated sky signs. Mr. Edwards puts the blame upon the engineers. It is not their fault that the "precious standards of value" have gone. The fault lies with a public which is unable to appreciate great works.

It has been said that a democratic country always gets the Government which it deserves; in other words, that the Government reflects the mind of the majority. The same might be said of those engineering works in which the display of artistic feeling is legitimate. It is not the critics or the artists themselves who establish standards of art, but the public. An age which can tolerate the defacement of public buildings and country roads by posters, an age which makes the promotion of trade and the attainment of commercial superiority the leading principle of its

activities, is not likely to inspire an art which is above such considerations. Our engineers have a far greater knowledge of the strength of materials and their right application than the great builders of a century ago, but they lack the artistic sense because the public mind fails to inspire it. In the less democratic days of the early part of last century there still remained an emotional environment capable of inspiring great works. In no other way can we account for the fact that men who had no training as architects, yet could carry on the tradition of the great builders who preceded them and erect bridges, viaducts and other works for railways which may challenge comparison with the products of classical periods. It is the spirit of the age that makes the artist, and if the civil engineers of to-day are, as Mr. Trystan Edwards contends, unable to design works to compare with those of their predecessors, it is because they lack the inspiration which springs, and springs only, from the general mind of the people.

The Purification of Water Supplies.

IN another column we give a *précis* of the contents of Sir Alexander Houston's twenty-second Annual Report on the water supplies of London. It has always seemed to us a great pity that these Reports are not more widely read, than they are, by the inhabitants of the Metropolis. Were their contents to be more generally known, the water users of London would appreciate more highly than most of them do the very considerable benefits which they enjoy. Water consumers, as a body, do not trouble themselves as to where the water comes from or as to how it is led to their taps, and are only concerned should anything go wrong. They are quick enough to complain should the flow fail, should the water be somewhat coloured, or—in these days of chlorination—should it have an unpleasant taste. But they fail to notice how much more frequently all is well, and, consequently, sufficient credit is not—in our opinion—given to those who are responsible for maintaining the continuity and the purity of the supplies. The engineering problems which are involved in providing, say, from 35 to 40 gallons per head per day for a vast aggregation of persons numbering some 7,000,000 are in themselves gigantic. They have involved the construction of storage reservoirs which are, together, capable of containing some 20,000 million gallons of water. The last to be built—the Queen Mary Reservoir at Littleton—covers an area which is some 100 acres greater in extent than the combined space occupied by Hyde Park and Kensington Gardens. They have involved, too, the sinking of numerous deep wells; the construction of many acres of filter beds; the provision of very many pumping engines of most diverse natures and capacities; and the laying of vast networks of supply mains and distribution pipes. Nor do the problems to be faced and solved by the engineer end there. He has to see to it that, no matter what the climatic conditions—whether there be drought or flood or frost—the supply does not fail.

For the moment, however, we are not so much concerned with the work of engineers as with that of those who are responsible for the purity of the water supplied. It has to be admitted that, with the exception of water obtained from deep wells in the chalk—and even some of that is not always above suspicion—all the water consumed within the area controlled by the Metropolitan Water Board is obtained from more or less polluted sources. Whatever they may have originally been, neither the Thames nor the Lee nor the New River can, nowadays, be regarded as unsullied streams. Conservators may—and do—do their utmost to prevent the access of impurities to the rivers under their charge, but in a thickly populated country like ours, where animals graze in fields through which those rivers flow, they can hope to do no more than reduce to a minimum the influx of undesirable matters and liquids. And so it comes about that the raw material from which the water supplied to Londoners is prepared is, at the outset, contaminated, and were it to be consumed in an untreated form, epidemics of disease would certainly and very quickly make their appearance. As things are, however, the standard of the purity of London water is astonishingly high, and London is the healthiest of the large cities of the world. We use the word "astonishingly" in the sense of "superlatively," and not as suggesting surprise; those who are acquainted with the care which is taken to bring about the results that are achieved are not surprised that those results are arrived at. The Reports of Sir Alexander Houston have explained year by year the progressive steps by which the standard has been maintained. London was, as he explains in this year's report, the home of water purification. Slow filtration is known throughout the world as the "London system." By it extraordinarily good results are obtained, but, for large volumes of water, large areas of land are necessary, and in crowded districts where land is dear slow filtration becomes expensive. For many years, however, it was the only method practised, on a large scale. Then again, to a dweller in London, though he is not a native of the city—Sir Alexander Houston—belongs the credit of discovering that by storing river water in reservoirs the pathogenic germs are destroyed, and he, too, we believe we are right in saying, introduced the excess-lime system of treatment. Comparatively recently, in order to economise in space, prefiltration in rapid filters prior to treatment in ordinary sand filters at a rate considerably—about three times—the ordinary speed has been tried by the Board on an extensive scale, with results which, from some points of view, have been exceedingly encouraging. It seems possible, however, that it may be found necessary, in practice, to use coagulants in the raw water, especially if stain has to be removed from the effluent.

Investigations, such as those which have resulted in the developments indicated in the foregoing, are continually being made by those who are in charge of water supplies. Among the latest discoveries is the treatment by chlorine, in some form or other, which is rapidly attaining world-wide application. By dosing water with chlorine—either as so-called chloride of lime or bleach, or in the gaseous state—an extraordinary degree of purification can be effected, at an almost negligible expense. The application of this discovery has, in the case of London water, had some noteworthy results. Its adoption was determined upon by the Metropolitan Water Board, when in 1916—at a time of stress when it was desirable to conserve our supplies of fuel in every possible way—it was pointed out by Sir Alexander Houston that chlorination, while producing entirely satisfactory results as regards "safe" water, would to a large extent do away with the necessity for pumping the water into reservoirs, and result in a considerable economy in coal. A very large saving was experienced, and since that time, though the urgent necessity for being sparing in fuel has passed away, the method has been retained, and a large saving of money effected. To-day, some 2,000,000 people are being, day after day, supplied, in London alone, with water which has gravitated direct from the river to the filters, without having passed some time in storage reservoirs; and, at the same time, the consumers are receiving water which is every whit as pure bacteriologically as though it had been treated by prolonged storage, followed by slow filtration. On that point, all consumers can rest fully assured. Sir Alexander is such a stickler for purity in water supplies that we feel sure that, were it possible, he would insist that they should have only water which was chemically and bacteriologically perfect. No amount of saving in finances would persuade him to consent to a water of the purity of which he was not absolutely convinced being sent into the supply mains. There is no more carefully safeguarded supply in the world than that of the Metropolis. Much as the chlorine treatment has done already, it would seem not improbable that in the future it will do considerably more. By its aid, it is very possible that waters which have hitherto been regarded as hopelessly impure may be rendered wholesomely potable. If that should prove to be the case, then the country's sources of supply will be sensibly increased.

The North-West England and North Wales Electricity Scheme.

ANOTHER electricity scheme, the fourth to be prepared, and relating to North-West England and North Wales, has been transmitted by the Electricity Commissioners to the Central Electricity Board. It deals with an area of about 9082 square miles, covering the counties of Lancaster, Cumberland, Westmorland, Anglesey, Carnarvon, Denbigh, Flintshire, Merioneth, and Montgomery, and parts of the counties of Chester, Cardigan, Derby, and Shropshire. It stretches from the Scottish border to the county of Radnor and from St. George's Channel to the boundaries of Northumberland, Durham and Yorkshire. At the last census the population of the area was 6,980,925. Within the area there are densely populated industrial centres, wide tracts of agricultural territory, and extensive moorlands. At present there are 122 authorised undertakers in the area, owning between them seventy public generating stations. During the year 1926–1927 the consumption of electricity per head of population was 185 units, but it is expected that it will increase to 429 units in the year 1934–1935. In accordance with the proposals set forth in the scheme, twenty-seven of the existing stations and two new stations—one at Manchester and the other at Liverpool—will become selected stations, and will be operated by the Board. The names of the existing selected stations are given below:—

Accrington (Accrington Corporation).
Agecroft (Salford Corporation).
Ashton-under-Lyne (Ashton-under-Lyne Corporation).
Atherton (South Lancashire Tramways Company).
Barton (Manchester Corporation).
Stuart-street (Manchester Corporation).
Bolton (Bolton Corporation).
Bury (Bury Corporation).
Chadderton (Oldham Corporation).
Hartshead (Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board).
Kearsley (Lancashire Electric Power Company).
Padiham (Lancashire Electric Power Company).
Radcliffe (Lancashire Electric Power Company).
Lancaster (Lancaster Corporation).
Lister Drive (Liverpool Corporation).
Nelson (Nelson Corporation).
Percival-lane (Mersey Power Company, Ltd.).
Rawtenstall (Rawtenstall Corporation).
Ribble (Preston Corporation).
St. Helens (St. Helens Corporation).
Southport (Southport Corporation).
Stockport (Stockport Corporation).
Trafford (Stretford Urban District Council).
Wallasey (Wallasey Corporation).
Warrington (Warrington Corporation).
Wigan (Wigan Corporation).
Willowholme (Carlisle Corporation).

Details of alterations and extensions to some of these stations and particulars of the two new stations are given in an appendix to the scheme. It is contemplated that six other coal-fired stations will come into the scheme under temporary arrangements, and that use will be made of two hydro-electric stations belonging to the North Wales Power Company. Sources of waste heat will in all probability be utilised.

Broadly speaking, ten of the selected stations will supply the base load, whilst the remainder will be used for meeting the peak load, but it is thought that in due course it will be possible to reduce the number of peak load stations. Needless to say, the stations are to be interconnected by high-pressure transmission lines, which will be designed as a series of ring mains, so that there will be alternative routes to the points of supply, and consequently greater security against breakdown. The main transmission system will comprise 384 circuit miles of line and there will be twenty-four transforming stations. The interconnection of the stations is expected to result in the release for revenue-earning purposes of about 127,000 kilowatts of plant now kept as spare and representing about £2,159,000.

The only undertaking in which standardisation of frequency is essential is that of the Stalybridge, Hyde, Moseley and Dukinfield Tramways and Electricity Board, which now operates at a frequency of 40 cycles per second. The estimated cost of carrying out this work is £399,500. The cost of the scheme to the Central Board for the erection of the transmission system is estimated at £4,834,718, whilst the undertakers will have to spend about £4,297,620 on the erection of the two new stations and on the extensions to some of the existing stations. The saving in capital expenditure up to the year 1934–1935 is expected to be £2,144,762, as compared with the expenditure that would be necessary if the present system were continued. After that date the saving on capital expenditure will, it is stated, be progressively greater, as compared with the capital necessary under the present system of individual development. The Commissioners estimate that in five years—1930–1935—there will be a saving to the undertakers in the area of about £2,780,253, or an average of half a million pounds per annum.

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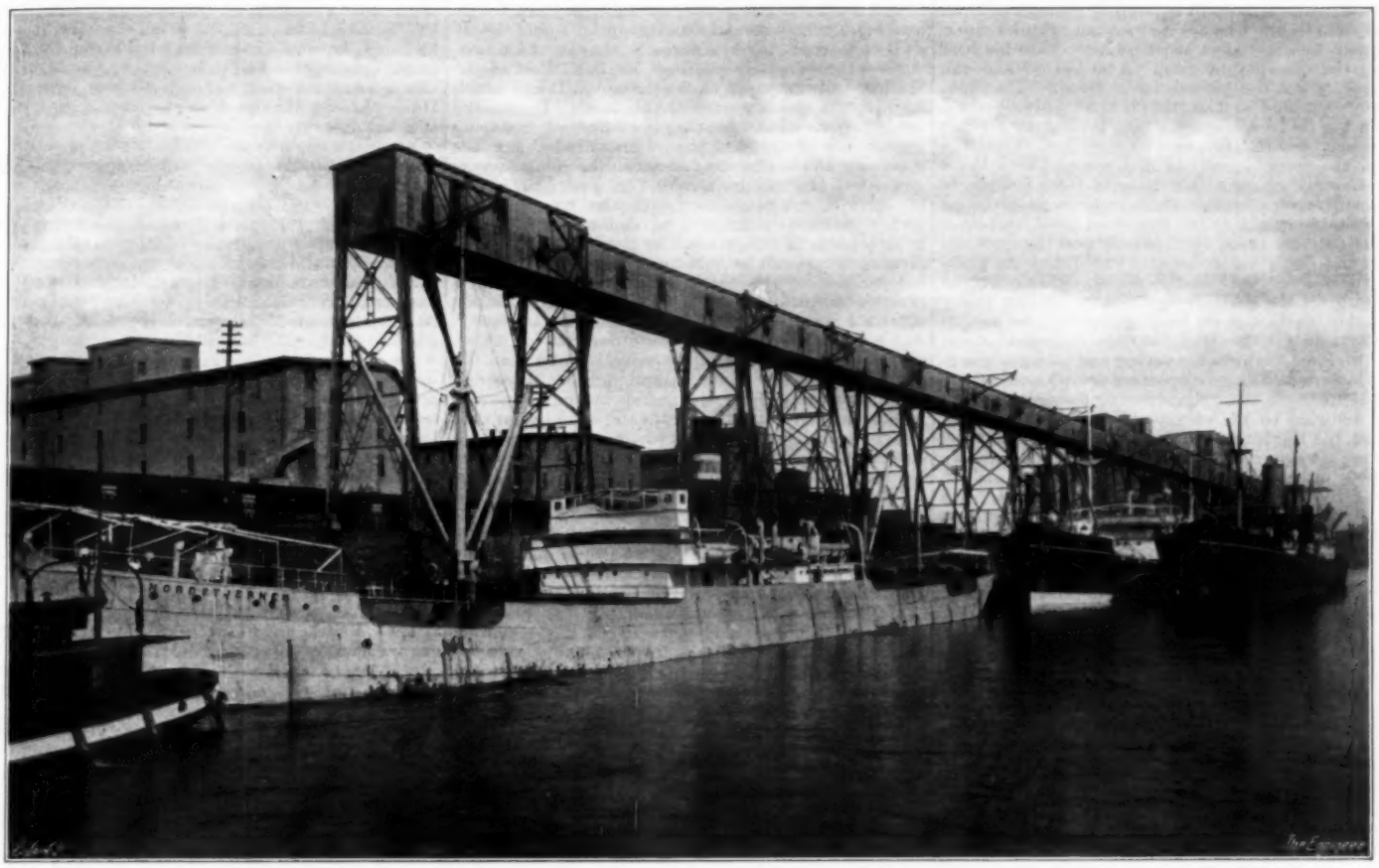
GRAIN ELEVATOR EQUIPMENT AT MONTREAL



CONVEYOR GALLERIES AT WINDMILL POINT BASIN

The Grain Elevator System at Montreal.

WITH the completion this spring of a three million bushel extension to No. 3 elevator, the huge grain elevator system at the Port of Montreal now boasts a total capacity of 15,162,000 bushels. The Montreal Harbour Commissioners control, in all, four big elevators; which are known as B elevator, No. 1 elevator, and Nos. 2 and 3. Elevator B has a capacity of 3,500,000 bushels; while No. 1 holds 4,000,000 bushels; No. 2 2,662,000 bushels, and No. 3 now has a total capacity of 5,000,000 bushels.

The grain-handling facilities at the Port of Montreal are a source of pride and admiration to the inhabitants of the city. The grain is transferred from canal grain barges into the elevators by a marine leg attached to the harbour elevators. At elevator No. 2 there are two marine legs, one of which is stationary, while the other can be moved about on tracks. There is a similar arrangement at elevator No. 1. At elevator No. 2 there are two legs, both stationary; while at elevator No. 3 there are four legs, all movable. Only one boat can be unloaded at a time at elevator B and No. 1, but at elevator No. 2 the marine legs are arranged one at each side so that two boats can be unloaded simultaneously. The same applies to elevator No. 3. In the case of that elevator, however, there are two legs on each side of the jetty, which means that the unloading operation can be carried out in about half the time that it takes at elevator No. 2. At present the Montreal Harbour Commissioners, who control all navigation and harbour facilities in the port, can unload six grain vessels simultaneously.

In order to avoid confusion a system of telephonic communication between the departments of the Harbour Commissioners has been installed. When a grain boat arrives in port with a cargo of grain to unload, it receives orders from the harbour master under which marine leg or legs it is to be placed. The harbour master, in turn, has been in touch with the superintendent of elevators, who decides upon the distribution of the grain into the elevators. From a central office in the main elevator, where a duplicate layout of all bins is illustrated upon a board, the superintendent orders the placing of the grain in any specific bin or bins. These instructions are telephoned from his office to a marine leg operator, the weighmen and distributing men, who immediately set into motion the necessary belts to carry out the operation.

Coloured lamps provide inter-communication signals between the various men engaged in the operation. When a marine leg operator has a clear signal, he puts into operation the marine leg in the hold of the vessel to be unloaded. The leg is so counter-weighted that, for a short time, it continues to lower itself into the grain in the hold of the vessel by means of its own weight. Thus the natural flow of the grain to the foot of this leg feeds the buckets which are fastened to an endless belt. A typical bucket measures 26in. by 8in. by 8in., and is cup-shaped in order to give a clean discharge when it reaches the top of the head pulley. The buckets are placed upon the belt at 11in. centres. The head pulley is about 72in. in diameter, and runs about twenty-four revolutions to the minute. Special attention has been given in Montreal to the drive of these head pulleys. Rope-drives have been eliminated, and double-reduction chain drives placed directly upon the marine legs give entire satisfaction.

As each bucket of grain passes over the top of the head pulley its contents are discharged at a tangent into a spout leading to the foot of another arrangement known as the lofter leg. The rated unloading capacity of a marine leg is 20,000 bushels an hour. This capacity is only maintained, however, during the time the grain is self-feeding to the marine leg. When the natural flow of grain is such that it does not feed fast enough into the leg, four, and sometimes six, shovelling gangs begin their work, by means of power shovels, to feed the grain to the leg.

The power shovel mechanism is arranged in the marine tower and consists of mechanically-operated revolving drums to which the ropes pulling the shovels are attached. The man handling the shovel simply scoops up a load and guides it to the marine leg, the drums doing the pulling. This shovelling operation reduces the average unloading capacity of the marine leg slightly. On the average it takes the leg, at a liberal estimate, about four hours to unload a vessel carrying a load of 80,000 bushels. In cases in which it is necessary to weigh the grain in the marine tower, the grain after being discharged from the marine leg belt buckets, is elevated to a garner placed immediately above a set of scales. A weighman releases a draught to the scale, weighs the grain, and allows it to deposit itself into a lower garner, placed immediately below the scales. During this operation, which is not unlike the action of a large scale hour-glass, grain continues to flow into the upper garner.

Following the weighing operation, grain is allowed to flow along the conveyor belt, which runs at a speed of some 700ft. per minute and carries 16,000,000 bushels of grain an hour. The grain is conveyed on this belt to the section of the elevator to which it has been allocated, and, by means of a tripper is deposited into the bin to which it has been ordered. Where the grain has not been weighed in the marine tower, it is deposited in boot-tanks below the general flow of the elevator, and is taken by means of a lofter leg to an upper garner, and thence to the scale and lower garner, from which point it is taken in the manner already described, to the lower bin. An average storage bin is some 23ft. in diameter by 100ft. deep, and holds approximately 33,000 bushels. The interspaces between the bins in an elevator also are used for storage purposes. With the full facilities of the port's elevator system in operation, inland grain vessels can be unloaded at the rate of 150,000 bushels an hour.

While the unloading of grain from cars cannot be done, in the aggregate, quite as rapidly as from the canal boats—average figures being given as 125,000 bushels an hour for this operation—it is a far more spectacular affair for the onlooker. As the grain car is run along the tracks to its position at the elevator, it is picked up and lifted bodily from the tracks, and then tilted at an angle so that the grain is literally poured from the box car into the elevator. Or else the car may be run on a track over a mechanism which shakes it so vigorously that all the grain is jolted and shaken out of a previously opened door into the elevator.

The Harbour Commissioners have in operation eleven of these specially constructed machines for unloading grain cars. One of their machines is at elevator B, two are at No. 1, and there are four each at Nos. 2 and 3. Each of these machines unload seven box cars, of 2000 bushels capacity each, per hour. They deposit the grain from the cars into boot-tanks, from which the grain is elevated to a garner that holds slightly in excess of one carload. This quantity is weighed in one operation, and then distributed to the desired bin. By the adoption of these huge unloading machines a great advance has been made over the old method of having men working with shovels in the cars and unloading the grain into elevators. Of the eleven unloading machines already mentioned, five are of the type which lifts the car bodily from the tracks, the other six being of the "shaker" type. The type which lifts the car from the tracks, tilts it both sideways and endways.

The "shaker" is constructed below the level of the elevator floor, with the car tracks running over it. The rail farthest from the elevator is raised 6in. above the level of the floor. The car then is drawn over the machine, which is set in motion. It is so constructed as to shake and jerk the car violently enough for all the grain to be precipitated through an open door, and the raising of one of the tracks, as described, ensures that the grain will be shaken and precipitated in the right direction. It should be explained that as the car is pulled on to the tracks over the machine, clamps are raised mechanically which grip the couplings of the car and hold it fast. The power, controlled by the operator of the machine, is applied through a shaft having an excenticity of about 3in. and running at 100 revolutions per minute. This gives a reciprocating motion to the car.

Delivery of the grain to ocean-going vessels can also be made very rapidly. On a continuous operation ocean vessels can be loaded with grain at a maximum rate of 450,000 bushels an hour. An ocean steamer ready to take in a cargo of grain is ordered to its berth by the harbour master, the elevator superintendent issuing orders at the same time to his staff giving the quantity of grain to be loaded and the bin from which the grain is to be taken. The grain is then permitted to flow from a valve in the bottom of the bin on to a conveyor belt leading to a lofter leg, which elevates the grain to a garner. From the garner the grain is weighed and released to a lower garner, from which it is fed on to belts leading to grain conveyor galleries. These galleries are arranged at a suitable height above the wharf level, and have projecting from them 14in. spouts working on turnheads and easily controlled so as to divert the grain into the desired hold in the vessel. This conveyor system gives the harbour facilities for serving thirty steamship berths and for loading twenty-three vessels simultaneously. The Harbour Commissioners' elevators also have facilities for drying and cleaning grain, and Government grain inspectors are present at the Port of Montreal at all times during the grain season.

In addition to the elevator facilities already described, the Harbour Commissioners have one floating elevator always ready for service. It has a capacity of 7000 bushels per hour, but is used only for the purpose of lightering vessels. In conjunction with the harbour's elevator system and other facilities, the Commissioners operate their own machine shops. Their own force of maintenance men and millwrights attends to any minor breakdowns in any of the machinery and equipment. Fortunately, however, breakdowns are almost unknown, despite the fact that the system normally is in daily operation from seven o'clock in the morning until eleven o'clock at night, while, during rush periods, the grain elevator facilities are in operation for twenty-four hours at a stretch.

All motive power throughout the entire harbour plant of the Commission is electrical, including the specially constructed goods engines which operate on the harbour's own lines, hauling freight cars about the harbour. The Commissioners purchase their electric power in bulk by contract from the Montreal Light, Heat and Power Company. The current is reduced in pressure on the site and is distributed through the Commission's own sub-stations and transmission lines, there being at present approximately 28,000 horse-power connected.

The illustration at the head of this article shows the grain conveyor galleries at Windmill point basin. In the background is grain elevator B. The upper view on page 714 shows grain elevator No. 1. In front of the elevator a canal vessel is being unloaded. The lower view on the same page shows the Marine Tower Jetty in front of elevator No. 2.

Institution of Mechanical Engineers at Southampton.

No. I.

IN the selection of the place of the Summer Meetings of the Institution of Mechanical Engineers, the wishes of the President receive the first consideration. With Mr. R. W. Allen as President, it is not surprising that Southampton was chosen this year, for Mr. Allen's firm has a large connection, both with ships and with docks, and he has, therefore, numerous friends in that centre who could help in furthering the success of the meeting. That the selection met with the approval of the members is evident by the large number who have attended during the past few days, and that they were delighted with their visit and their reception by the local committee, and by all those who entertained them, could be gathered from the comments that were heard on all sides. Moreover, ships have a charm of their own, as may be judged from the fact that the Southern Railway finds it profitable to run periodically excursions to Southampton just for the benefit of those who like to see stately liners, warships, and racing craft. Furthermore, the neighbourhood provides not only many famous "sights," but several works and factories in which engineers could find much of interest.

The meetings opened in the Chantry Hall, St. Mary's, on Tuesday morning last, when the Mayor, Mrs. L. M. Foster Welch, and the members of the Reception Committee welcomed the President and members to Southampton. The Chantry Hall is a newly completed building of simple but charming internal design, and accommodated easily the five hundred or so people who attended the opening meeting.

In welcoming the Institution to Southampton, the Mayor alluded to the wide influence of mechanical engineering, and promised the visitors that they would find much of interest, not only in the modern development, but in the antiquities of a seaport which might justly be called one of the Gateways of the Empire.

The President acknowledged the welcome which had been proffered by the Mayor, and thanked the local Reception Committee for the admirable programme which it had arranged. It was, he said, the first time that the Institution had been received by a lady Mayor; it was also the first time that it had visited Southampton. He felt sure that by the end of the week the Institution would hope that, before many years had passed, Southampton would invite it, once more, to hold its Summer Meeting there.

After these friendly greetings, Mr. F. E. Wentworth-Sheilds read the paper on Southampton Docks which we print in another part of this issue. It was the only paper. The growing practice of reducing the number of technical papers presented at summer meetings to the almost irreducible minimum is greatly to be commended. The principal object of such meetings is to bring the members together in friendly intercourse and to enable them to see things of interest in the place visited. Technical meetings can be held anywhere and are almost independent of the surroundings. Before the new practice was adopted, and whilst the old traditions of the time when the Institution was peripatetic still lingered, two mornings were devoted to papers, and we can recall nothing more melancholy than the attendance at the meetings and nothing more disappointing for authors who had spent much time and labour on their contributions in the expectation that a large audience would hear them and that a good critical debate would follow. It is unlikely that the Institution of Mechanical Engineers or other institutions which have already adopted the new method will return to the old.

Although Mr. Wentworth-Sheilds' paper was mainly descriptive, it was followed by a quite interesting discussion, which was opened by Mr. Asa Binns, Engineer to the Port of London Authority.

Mr. Binns called attention, in the first place, to the remarkable developments in dock engineering which are going on in this country; he alluded to the completion of the Gladstone Dock last year, the recent opening by the Prince of Wales of dock extensions at Bristol, and the important new quay which has only just been built at Newcastle-on-Tyne, and he added that the Port of London Authority had a five-million-pound scheme in hand. It was difficult to get money, but there was no lack of enterprise. Trade did not always flow in the right direction, but he believed the time was coming when British ports would export what they ought to export and that imports would come naturally. London sometimes had to follow Southampton in dock development schemes, and was not ashamed to do so, although occasionally it found it expensive, as in the case of a 150-ton floating crane which it had purchased, but for which it could never expect to find remunerative occupation. He congratulated Southampton on having the Southern Railway to pay for its dock developments.

Mr. Cecil Bentham (Henry Simon Ltd., Manchester) followed. He criticised Southampton for having devoted so much attention to the passenger traffic and so little to cargo liners and tramps. The storage accommodation was very small, and he believed that were provision made for goods, Southampton might rival London. Furthermore, the accommodation for grain was quite inadequate, and modern grain-carrying vessels had to discharge their cargoes into lighters, and thence into the silos. If the grain-handling plant were brought up to date, great liners with grain ballast would come to the port. It was a remarkable fact that Southampton was the only great port in the kingdom without a large flour mill. Finally, Mr. Bentham criticised the large use of hand trucks which the author had mentioned. Whilst it was true that hand trucks would have to be used for some portion of mixed cargoes, he was confident that 90 per cent. could be profitably handled by conveyors.

Mr. Hunn advocated the development of Southampton as an air port. Liverpool was taking steps in that direction, and the municipality ought to see to it that Southampton did not fall behind. There was, he said, already an important air service with Guernsey, and it was increasing. He was confident that the time was not far distant when large multi-engined aeroplanes would maintain a regular twenty-five hours' service with New York. He believed also that in a short time liners would carry aeroplanes. By flying 300 miles at each end of the Transatlantic passage twenty-six hours might be saved.

The remainder of the discussion was mainly devoted to short observations or questions. Mr. Dunn urged the port authorities to consider the use of high-pressure gas for illumination. Mr. Patchell said he was glad to see that both alternating and direct current was used, for the latter had great advantages for intermittent and variable loads; Sir Henry Fowler spoke of the merits of petrol-driven trucks, of which the L.M.S. Railway has now several in successful use; Mr. Daniel Adamson said he understood that nickel accumulators took a long time to charge; and Professor Spooner supported Mr. Dunn in his advocacy of high-pressure gas.

In his reply, Mr. Wentworth-Sheilds said that the new scheme of development of the docks, briefly described in the paper, would cost about £3,000,000. He agreed with Mr. Binns that large floating cranes did not directly pay for themselves, but, nevertheless, docks were obliged to have them. With regard to Mr. Bentham's criticism, he stated that the storage accommodation was sufficient for the port, which prided itself particularly on the fact that it effected exceptionally quick deliveries. He admitted that grain handling was not a strong point at Southampton, but it would be improved. Decision on the right course to pursue was made difficult by the fact that there was a growing tendency to import flour instead of wheat. In spite of all that Mr. Bentham had said, he was still convinced that for the nature of the cargoes that had to be handled the hand truck was a wonderful tool. He agreed heartily with Mr. Hunn that Southampton might have a great future as a sea air-port.

After the usual votes of thanks, the members and friends adjourned to the adjacent gardens, where a panoramic group photograph was taken.

The whole party then proceeded to the Ocean Dock, where R.M.S. "Homeric" was lying. The White Star Line had invited the Institution to take luncheon on board, and then to make an inspection of the vessel, and subsequently to visit Harland and Wolff's yard or the great laundry of the White Star Company. At the luncheon Mr. Curry, of the White Star Line, was in the chair. The beautiful dining saloon of the "Homeric" was taxed to its limits, but an admirable luncheon was served. At the conclusion, the Mayor proposed the toast of "The Institution" in a short speech, of which Mr. Allen made graceful acknowledgment. He had, he said, sent a telegram to Lord Kylsant to thank him for his courtesy in entertaining the Institution. Mr. Adamson, senior Vice-president, then proposed the health of the White Star Line, and Mr. Curry and the Commander of the "Homeric" said a few words in reply.

Alternative visits were arranged for the afternoon, and whilst some stopped on the "Homeric" others paid a visit to the works of John I. Thornycroft and Co., at Woolston, whilst others made a tour of the docks. A little fire which broke out in an outlying part of Thornycrofts yard just before the visit was not allowed to interfere in any way with the arrangements, which were carried out quite undisturbed by the mishap. In the evening the members and their friends attended a reception and dance in the Royal Pier Pavilion at the invitation of the Mayor and Corporation of Southampton.

Wednesday was given up entirely to visits of one kind and another. One large party took an early special train to Eastleigh, to see the locomotive or carriage works of the Southern Railway. In the afternoon some went to the Supermarine Aviation Works, the works of J. Samuel White and Co., Ltd., and the Ordnance Survey Department, or others, less bent on their technical education, drove out to Romsey and Winchester. In the evening the Institution gave a banquet in the South-Western Hotel. The accommodation in the hall was limited to about 230, but room for others was found in the adjoining grill room, to which the speeches were transmitted by amplifiers. Immediately after the loyal toasts had been honoured, the President, Mr. Richard Allen, rose and said that that was not only the first occasion on which the Institution had visited Southampton, but the first time that it had ever been received by a lady Mayor. The Council felt that such a notable event should not be allowed to pass without special recognition, and on behalf of the Council and members he asked the Mayor to accept a diamond brooch as a souvenir of that meeting. The Mayor (Mrs. Foster Welch) acknowledged the gift in a few words which showed how much she was moved by the presentation and what pleasure it gave her. Mr. Loughnan Pendred then proposed the toast of "Southampton." He alluded to the great development of the town and the docks, and called particular attention to the splendid work done by the railway company. In responding to the toast, the Mayor gave a brief outline of the historic past of Southampton, whilst Mr. Wentworth-Sheilds described the development of the dock extension schemes, and touched upon the other engineering interests of the neighbourhood. The only other toast was that of "The Institution," which was proposed by Mr. Curry, of the White Star Line, and was, of course, acknowledged by the President. Both speakers referred to the great work of mechanical engineering in the past, and expressed the belief that the future would see advances as great and as remarkable. It was generally agreed that the dinner was unusually successful.

Many other visits were arranged for Thursday, amongst which we may mention those to the R.A.F. Seaplane Station, the Pirelli-General Cable Works, the "Aquitania," the Southampton Waterworks, and an excursion to the New Forest and Beaulieu Abbey. To-day—Friday—is being devoted to Portsmouth, where various municipal works are being visited, and where one party is being entertained on H.M.S. "Barham" by the officers.

SOUTHAMPTON SUMMER MEETING VISITS.

We give below some notes on the principal works, &c., to which organised visits were paid.

On Tuesday, after the reading of Mr. Wentworth-Sheilds' paper, the visitors were entertained to luncheon on the R.M.S. "Homeric," by invitation of the White Star Line, and subsequently a party inspected the vessel under the guidance of her officers. The "Homeric" has a length between perpendiculars of 750ft. and a gross tonnage of 34,350. Her two sets of four-cylinder triple-expansion engines develop an aggregate of 36,000 I.H.P. and give the

vessel a service speed of 20 knots. Her propellers are three-bladed and each propeller weighs over 6¼ tons. Steam is supplied by twelve double-ended Scotch boilers working at 206 lb. pressure. In 1924 the boilers were converted for oil firing on the Todd system. The equipment of the vessel includes the Howden system of forced draught, the Foamite system for extinguishing fire, Linde CO_2 refrigerating machines, and water-tight doors operated on the Stone-Lloyd principle.

JOHN I. THORNYCROFT AND CO., LTD.

Leaving the "Homeric," those who had inspected her proceeded to the works of John I. Thornycroft and Co. at Woolston. These works were acquired and reconstructed by Messrs. Thornycroft in 1905. For half a century they had been used for the building of sailing and steam vessels. They cover an area of about 35 acres and have an extensive frontage on the river Itchen. There are eight building berths and one covered building shed, and vessels up to 450ft. in length can be built. The engine shop has been laid out to deal with the construction of turbine machinery for destroyers up to 40,000 horse-power. A feature of the equipment is a dynamic balancing machine for turbine rotors. In the boiler shop a conspicuous section is the electro-zincing plant for coating boiler tubes in accordance with Admiralty requirements. In addition to carrying out new construction the yard undertakes a large amount of repair work. There is a special department for making and repairing the upholstery for large liners. At the present time the yard is engaged on the construction of six Chilean destroyers, some shallow-draught cattle vessels, a number of tugboats and a motor yacht. It has just received an order for the hull and boilers of a special experimental destroyer for the British Admiralty.

HARLAND AND WOLFF AND WHITE STAR LAUNDRY.

As alternative visits parties inspected the ship repairing and engineering works of Harland and Wolff, Ltd., and the White Star Laundry. The Harland and Wolff works were established by the late Viscount Pirrie in 1907, about which time the White Star Line began to use the Southampton-Cherbourg-New York route. They lie close to the largest of the port's dry docks and to the large floating dock and are therefore well placed for the execution of rapid repair work. During the war the works were enlarged by 50 per cent. and in 1920 the repair works of the Royal Mail Steam Packet Company and those of the Union-Castle Company were taken over. The principal work undertaken is the repair of the liners of the White Star, Royal Mail and Union-Castle companies. Everything required to keep a modern liner in efficient condition is to be found in the establishment. In addition to the ordinary equipment of a marine repairing shop the works include plant for joinery and cabinet making purposes, an extensive electro-plating plant for table ware, upholstery, carpet cleaning and bedding plant, electro-tinning plant for ships' cooking apparatus and other equipment.

The White Star Laundry is situated over the boiler shop at Messrs. Harland and Wolff's repairing establishment. The plant is entirely electrically driven and can handle from 90,000 to 130,000 pieces of linen per week. There are six large ironing machines, twelve washing machines, and eight hydro-extractors.

SOUTHAMPTON DOCKS.

As an alternative to the inspection of the "Homeric" and the other establishments named above, a party of the visitors after the luncheon made a tour of the Southampton Docks under the guidance of Mr. G. R. Newcombe, the Southern Railway Company's Docks and Marine Manager. The first dock was opened in 1843 by the Southampton Dock Company. That company continued to carry on the undertaking until 1892, when it disposed of it to the London and South-Western Railway. The railway company made successive additions to the accommodation, and in 1911 opened the Ocean Dock, which has a depth of 40ft. alongside at low water of ordinary spring tides. During the war the docks were under Government control and were used for the despatch or landing of 7,689,510 troops and a vast quantity of munitions and baggage. To-day the port claims to handle a third of the country's total passenger traffic between the United Kingdom and places outside Europe. Grain, fruit and timber are the principal items of cargo traffic. There are six graving docks and a 60,000-ton floating dock. A great scheme of dock extension is now in hand, and as a result Southampton may one day become the country's leading seaport.

EASTLEIGH.

On Wednesday, June 27th, the morning was devoted to a visit to Eastleigh, where the Southern Railway's Locomotive and Carriage and Wagon Works were inspected. The Eastleigh locomotive works were laid out in 1909 to the plans of the late Mr. Dugald Drummond, and are now used for the construction of new engines and for the maintenance of the 860 locomotives which formerly belonged to the London and South-Western Railway. The main building is 800ft. long by 400ft. wide, and covers the erecting shop, the fitting shop, the machine, wheel and boiler shops. External to it are the foundries, forge and brick shop. In the last-named department all the fire-bricks for the locomotive furnaces, &c., are prepared. An interesting subsidiary plant is the "Tern" equipment for reclaiming the oil from the swabs issued to the drivers, cleaners and workshops.

The carriage and wagon shops were built in 1890. Since the amalgamation a large amount of wagon building has been allotted to the company's Ashford works, leaving the Eastleigh shops free to deal with coach building and maintenance. Recently the works have been reorganised on a mass production basis, with a resultant large increase of output. The shops comprise a saw mill, a body shop, a repair shop, and a forge and smiths' shop. In the body shop a gang of thirty-four men and boys can build a corridor third-class coach of eight compartments, with two lavatories, in twenty-one hours. The underframes are run in at one end of the shop between stagings, and no coach is allowed to remain at any one staging longer than thirteen hours. In the repair shop a standard coach can be thoroughly examined for framing and the bogies removed and replaced in 1¼ hours.

(To be continued.)

Fuel Conference.

THE following papers will be presented by the British delegates to the Fuel Conference of the World Power Conference, which is to be held at the Imperial Institute, London, between September 24th and October 6th next.

SECTION A: THE COAL INDUSTRY—ECONOMIC AND GENERAL CONSIDERATIONS.

(1) The Constitution of Coal. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Professor R. V. Wheeler.

SECTION C: COAL TREATMENT—(*a*) CLEANING, (*b*) DRYING, (*d*) BRIQUETTING.

(2) The Cleaning of Coal, with special reference to the Smaller Sizes. Authoritative Body: The Institution of Mining Engineers. Author: Dr. W. R. Chapman.

(3) The Washing of Coal by "Abnormal" Processes. Authoritative Body: The Institution of Mining Engineers. Author: Professor E. Edser.

(4) The Dry Cleaning of Coal. Authoritative Body: The Institution of Mining Engineers. Author: Mr. G. Raw.

(5) The Dry Cleaning of Coal. Authoritative Body: The Institution of Mining Engineers. Author: Major K. C. Appleyard.

(6) The Dewatering and Drying of Coal. Authoritative Body: The Institution of Mining Engineers. Author: Mr. R. A. Mott.

SECTION D: STORAGE AND HANDLING OF SOLID FUELS BY THE USER.

(7) The Storage and Handling of Solid Fuels by the User. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Mr. R. K. Stockwell.

SECTION E: THE OIL INDUSTRY—ECONOMY AND GENERAL CONSIDERATIONS.

(8) The Economics of the Oil Industry, including the Influence of By-products. Authoritative Body: The Institution of Petroleum Technologists. Author: Mr. E. H. Davenport.

SECTION F: COMPOSITION, CLASSIFICATION, PREPARATION, STORAGE AND HANDLING OF LIQUID FUELS.

(9) Modern Developments in Oil Distillation. Authoritative Body: The Institution of Petroleum Technologists. Authors: Dr. A. E. Dunstan and Mr. J. Kewley.

(10) Modern Developments in Oil Refining. Authoritative Body: The Institution of Petroleum Technologists. Authors: Dr. A. E. Dunstan and Mr. J. Kewley.

(11) Modern Developments in Oil Cracking. Authoritative Body: The Institution of Petroleum Technologists. Authors: Dr. A. E. Dunstan and Mr. J. Kewley.

(12) The Technical Aspects of the Storage, Handling, and Transmission of Liquid Fuels by the User. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Mr. I. Lubbock.

SECTION G: THE CARBONISATION INDUSTRY—ECONOMIC AND GENERAL CONSIDERATIONS.

(13) The Coking Industry as a Source of Industrial and Domestic Energy, and the Trend of Development. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association and the Institute of Fuel. Authors: Mr. C. P. Finn and Mr. R. Ray.

(14) The Economics of Coke Manufacture in the Coke Oven Industry. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association and the Institute of Fuel. Author: Mr. M. Mackenzie, C.B.E.

(15) Coke Quenching and Cooling. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association and the Institute of Fuel. Author: Mr. W. Colquhoun.

(16) The Gas Industry as a Source of Domestic and Industrial Energy. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association and the Institute of Fuel. Author: Mr. F. W. Goodenough.

(17) Coke Screening. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association and the Institute of Fuel. Author: Mr. W. S. Edwards.

(18) The Utilisation of Coke Oven Gas by the Gas Industry. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association and the Institute of Fuel. Author: Mr. T. P. Ridley.

(19) The Fundamental Aspects of Combustion. Authoritative Body: Technical Committee, Fuel Conference, 1928. Authors: Professor W. A. Bone, F.R.S., Professor G. I. Finch, and Dr. D. T. A. Townend.

SECTION H: COMPOSITION, CLASSIFICATION, PREPARATION, STORAGE AND HANDLING OF GASEOUS FUELS AND OF THE PRODUCTS OF THE CARBONISATION INDUSTRY.

(20) The Fundamentals of Coal Blending and the Production of Solid Smokeless Fuel for Domestic Heating. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association and the Institute of Fuel. Author: Dr. J. G. King.

(21) The Production of Town's Gas and the Trend of Development. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association and the Institute of Fuel. Author: Professor J. W. Cobb.

(22) The Purification of Coal Gas. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association and the Institute of Fuel. Author: Mr. Charles Cooper.

(23) The Production of Gaseous Fuel from Liquid Fuels. Authoritative Body: The Institution of Petroleum Technologists. Author: Mr. J. Kewley.

(24) By-product Recovery in the Carbonisation Industry. Authoritative Body: The Joint Fuel Committee of the Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association, and the Institute of Fuel. Author: Mr. J. Parish.

SECTION J: UTILISATION OF FUELS FOR STEAM GENERATION AND THE PRODUCTION OF ELECTRICITY.

(25) The Economic Utilisation of Fuels in the Production of Electricity. Authoritative Body: Incorporated Association of Electric Power Companies. Author: Mr. R. P. Sloan, C.B.E.

(26) Fuel Oil for Steam Raising. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Commander A. L. P. Mark-Wardlaw, R.N.

SECTION K: UTILISATION OF FUELS, INCLUDING ELECTRICITY, FOR INDUSTRIAL FURNACE WORK.

(27) Industrial Heating by Solid, Liquid, and Gaseous Fuels. Authoritative Body: Technical Committee, Fuel Conference, 1928. Authors: Sir Robert Hadfield, Bart., F.R.S., and Mr. R. J. Sarjant.

(28) Industrial Electric Heating. Authoritative Body: British Electrical Development Association. Editor: Mr. S. E. Monkhouse.

SECTION L: UTILISATION OF FUELS, INCLUDING ELECTRICITY, FOR DOMESTIC PURPOSES.

(29) A Comparative Study of Solid Fuel, Gas, Electricity and Oil for Domestic Purposes. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Dr. Margaret Fishenden.

SECTION M: PULVERISED FUEL.

(30) Pulverised Fuel Firing. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Mr. F. H. Rosencrants.

SECTION N: INTERNAL COMBUSTION ENGINES.

(31) The Properties of Motor Spirit in relation to Engine Design. Authoritative Body: The Institution of Petroleum Technologists. Author: Mr. H. R. Ricardo.

(32) Fuel Oil for Heavy Oil Engines. Authoritative Body: The Diesel Engine Users Association. Author: Mr. Harold Moore.

SECTION O: TRANSMISSION OF POWER.

(33) The Transmission of Power Over Various Distances by the Alternative Methods of the Transport of Coal, the Transport of Oil, the Transmission of Gas and the Transmission of Electrical Power. Authoritative Body: Technical Committee, Fuel Conference, 1928. Editor: Dr. E. W. Smith.

SECTION P: WASTE HEAT RECOVERY.

(34) Waste Heat Recovery. Authoritative Body: Technical Committee, Fuel Conference, 1928. Assisted by: Mr. F. J. Bailey, Major W. Gregson, and Mr. J. Raber.

SECTION Q: LOW-TEMPERATURE CARBONISATION.

(35) Low-temperature Carbonisation. Authoritative Body: Technical Committee, Fuel Conference, 1928. Authors: Dr. C. H. Lander, and Dr. F. S. Sinnatt.

SECTION R: PEAT.

(36) The Drying of Peat. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Mr. N. Testrup and Mr. T. Gram.

SECTION S: POWER ALCOHOL.

(37) Alcohol for Power Purposes. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Colonel Sir Frederic L. Nathan, K.B.E.

SECTION T: TRAINING OF FUEL TECHNICIANS.

(38) The Training of Fuel Technicians. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Professor J. W. Cobb.

SECTION V: ORGANISATIONS CONCERNED WITH THE EFFICIENT USE OF FUEL IN INDUSTRY.

(39) A Survey of the Scope of Organisations Concerned with the Efficient Use of Fuel in Industry. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Mr. E. C. Evans.

SECTION W: ECONOMIC POSSIBILITIES IN THE BETTER CO-ORDINATION OF FUEL UTILISATION.

(40) A Fuel Policy. Authoritative Body: Technical Committee, Fuel Conference, 1928. Author: Sir Arthur Duckham, K.C.B.

SECTION X: TECHNICAL DATA ON FUEL.

(41) Technical Data on Fuel. Authoritative Body: Technical Committee, Fuel Conference, 1928. Editor: Mr. H. M. Spiers.

Caprotti Valve Gear.

THE first locomotive in Great Britain to be fitted commercially with the Caprotti valve gear was No. 5908, old London and North-Western Railway "Claughton" class, built at Crewe. This engine was first designed as a four-cylinder simple, superheated, and fitted with trick ported piston valves, operated by Walschaerts valve gear for the outside valves, with rocking levers connected from the ends of these valve spindles to the spindles of the inside valves.

The Caprotti gear, also fitted at Crewe, was adopted for the purpose of obtaining greater economy in steam consumption and running maintenance cost, owing in the former case to a better distribution of steam, and in the latter to a less number of motion parts, most of which run in oil. This gear consists essentially of one admission and one exhaust valve of the double-beat poppet valve type for the inlet and outlet of steam from each end of each cylinder, i.e., in all four valves per cylinder. These valves with the cages in which they work can be readily removed from the cylinders. In the older type of gear the weight of the valves is sustained by springs—see A, Fig. 1—but in the newer designs the springs, both on the admission and exhaust valves, are superseded by a small steam receptacle into which a downward elongation of the valve spindle fits. The receptacle is open to steam through the regulator pilot valve. This design—B, Fig. 1—has the advantage that when steam is shut off the valves drop readily from their seats, leaving free access from one end of the cylinder to the other.

The most noticeable feature of the gear is undoubtedly the gear-box itself. The type of box used on engine 5908 is that designed for a four-cylinder simple engine, two being used. Each box acts on the eight valves of one pair of cylinders, i.e., one outside and one inside cylinder next to it. The four admission valves are placed towards the central part of the gear-box in two groups of two valves each, whilst the exhaust valves of the inside cylinder are placed innermost and the exhaust valves of the outside cylinder are placed at the outer end of the gear-box. The number of cams for operating the valves for each cylinder—that is, for two admission and two exhaust—is reduced to a minimum of three. One pair of cams controlling, as will be shown later, the opening and closing of both admission valves, whilst the third cam controls the opening and closing of the exhaust valves.

The admission cams are fitted loose on the cam shaft and are driven by suitable means at the cam shaft's speed in such a way as to allow a shifting of the cam's position relatively to the shaft on reversal or notching-up of the engine motion. The exhaust cam is fitted solid with the shaft; consequently the compression and release are constant at any position of steam cut-off for either forward or back gear.

The cam shaft S—Fig. 2—is placed between the valves and carries cams which command rollers on bell-crank levers which act upon the valve stems. The motion of the levers, and consequently of the valves, is the same for both, but one follows the other by 180 deg., or by half a revolution. This arrangement provides for the alternate opening and closing of both admission and exhaust valves.

In order to provide for variable cut-off, two cams C and C_1—Fig. 2—are used; they are of the same profile, consisting of two symmetrical rest curves of different radii connected

Comparative Tests Between Engine No. 5908, "Claughton" Class, Fitted with Caprotti Valve Gear, and Engine No. 5917, Standard "Claughton."

	Crewe–Carlisle.			
	Engine 5908.		Engine 5917.	
	January 25th.	January 26th.	February 8th.	February 9th.
Weight of engine and tender (working order)	110·5		110·5	
Weight of train behind draw-bar	315·6	317·6	315·6	315·6
Total weight of train (engine, dynamometer car and carriages)	426·1	428·1	426·1	426·1
Train miles	141·27	141·32	141·26	141·34
Ton-miles, excluding weight of engine	44,585	44,883	44,582	44,697
Ton-miles, including weight of engine	60,195	60,499	60,191	60,225
Time running, minutes actual	159·9	177·27	165·91	174·7
Coal weight, excluding shed duties	9,418		12,577	
Coal, lb. per train mile, excluding shed duties	33·3		44·5	
Coal, lb. per ton-mile, excluding weight of engine and shed duties	·1054		·1409	
Coal, lb. per ton-mile, including weight of engine and excluding shed duties	·0781		·1043	
Coal, lb. per draw-bar H.P. hour, excluding shed duties	3·82		4·86	
Grate area, square feet	30·5		30·5	
Average running speed, m.p.h.	53·4	48·0	51·1	48·5
Maximum speed, m.p.h.	73·8	75·8	73·4	77·1
Gross work done by engine on draw-bar in H.P. minutes	64,942·5	82,700·5	74,408·0	80,598·25
Ditto ditto in H.P. hours	1,082·375	1,378·341	1,240·133	1,343·304
Maximum draw-bar H.P. (plus work)	780	905	763	858
Draw-bar H.P. hours per train mile	7·66	9·75	8·79	9·5
Draw-bar H.P. minutes per ton-mile (excluding weight of engine)	1·455	1·845	1·668	1·805
Water—				
Gallons per train mile	26·9		31·0	
Lb. per D.B.H.P. hour	30·9		33·85	
Lb. per pound of coal	8·08		6·96	
Gallons per trip	3,440	4,170	4,360	4,400
Total	7610		8760	

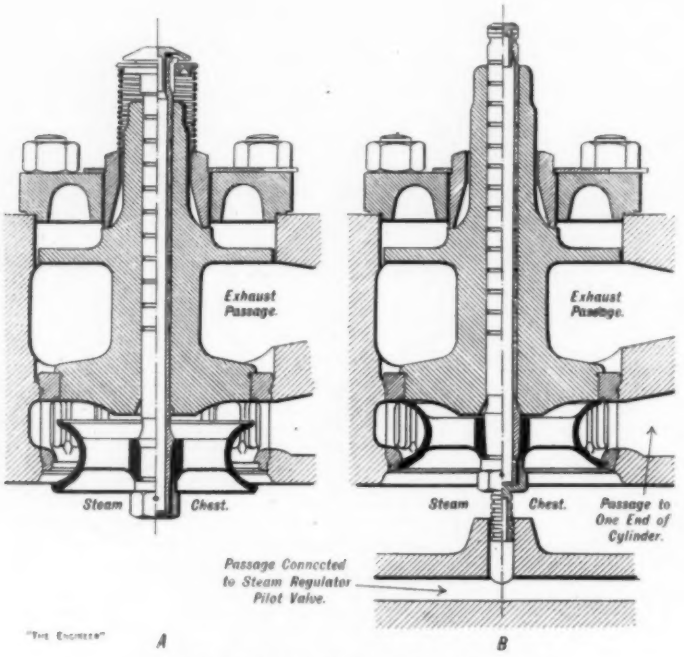


FIG. 1—VALVES—OLD AND NEW TYPES

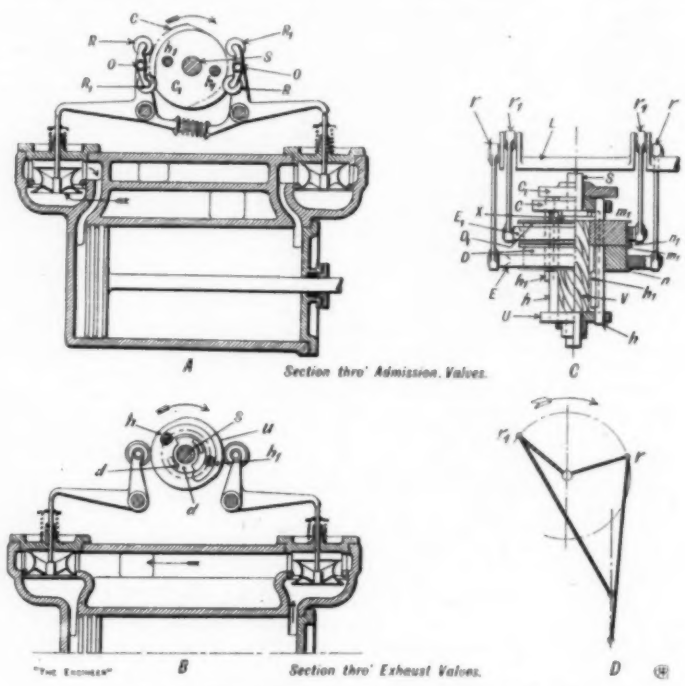


FIG. 2—MECHANISM OF CAPROTTI VALVE GEAR

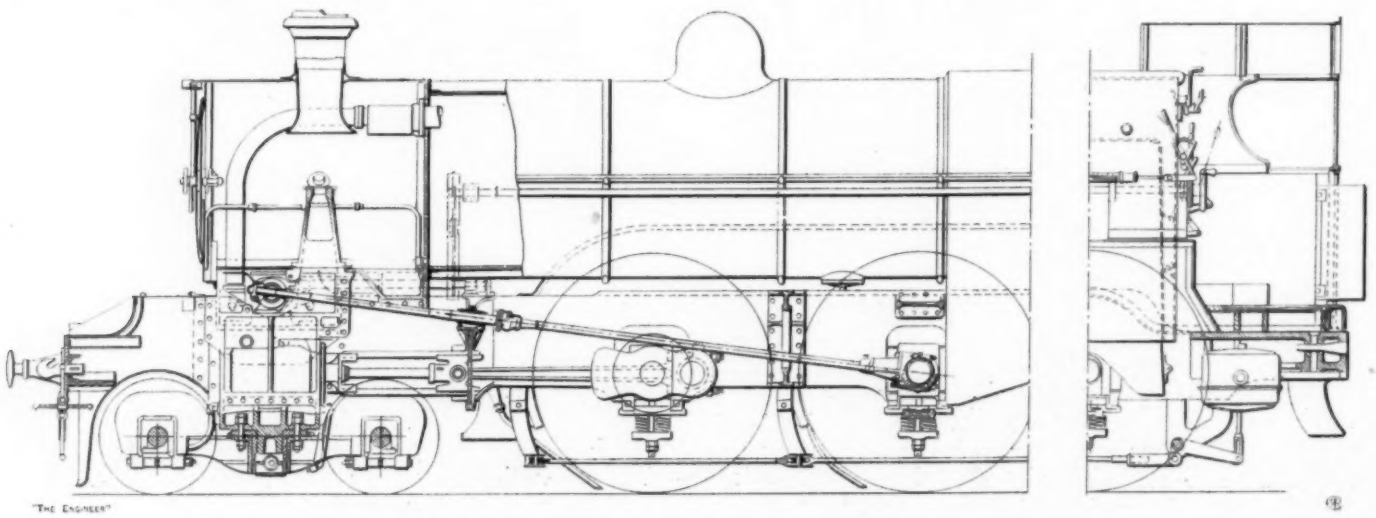


FIG. 3—DRIVING MECHANISM OF CAPROTTI GEAR-BOX

by two properly designed transition curves. These two cams are placed side by side, so that the end rollers R and R_1 of a symmetrical swinging beam pivoted at O at the end of the bell-crank lever are made to press the roller R on the cam C and the roller R_1 on cam C_1, so that the motion of point O is obtained by the combined action of both cams C and C_1—see A and C, Fig. 2.

On inspection of A, Fig. 2, it will be readily seen that there are two positions in which the point O remains at rest, one when both rollers are on high parts of the cams, the other when both are on low parts. It will also be at rest when one roller is on a high part and the other on a low. In forward gear cam C controls the cut-off, whilst cam C_1 controls the lead. On reversal the cams exchange their functions. By changing the relative position of the cams it is, therefore, possible to obtain a very wide range of cut-offs without reducing the lift of the valve or changing the lead.

The means of effecting alteration of the angular position of the cams must now be considered. Turning to C, Fig. 2, it will be seen that a quick-pitch screw thread is cut upon the cam shaft. With this screw two large circular nuts engage. These nuts are provided on the outside with collars controlled by connecting-rods and cranks on the reversing shaft L. A rod fixed in cam C_1 passes through a slot in cam C—see B, Fig. 2—but is a sliding fit in the nut D_1, whilst another rod fixed in cam C passes through a slot in the nut D_1 and fits a hole in the cam D. Hence longitudinal movement of either nut causes angular movement of the corresponding cam. Furthermore, since the nuts can be moved independently, the point of cut-off may be changed without altering the lead.

This condition can be approximately obtained by setting the cranks of the controlling shaft L in such a position —see D, Fig. 2—that whilst the pins r_1 r_1 move about one of their dead centres, the others $r\,r$ move about a position nearly at right angles to it, imparting the maximum shift to the other ends of the connecting-rods. In order to keep the nut of the opening cam absolutely motionless longitudinally, a certain amount of play is allowed between the collar and the rims of the nut, as seen in C, Fig. 2.

The gear is shown at the maximum cut-off in forward motion with the left inlet valve just opening (A) and the exhaust valve at the other end of the cylinder nearly full open (B). The direction of the rotation of the cams and cam shaft is shown by the arrows. It may be pointed out that the screw V, being left-handed, its clockwise rotation tends to keep the nut D_1 bearing against the butt ring X.

The whole of the mechanism in the gear-box works in an oil-tight chamber, the box itself being partially filled with oil and should not require replenishment for a period of six months. All bearings are of the ball type. The gear-box itself may easily be removed and replaced if necessary by the slacking off of two nuts and a locking piece, and a spare valve box be put in place if required, all valve boxes being absolutely standard in every respect.

In the engine fitted by the London, Midland and Scottish Railway Company there are two gear-boxes, each box operating eight valves. The boxes are driven by a short cross shaft under the smoke-box which is shown in the diagrams, the bevel gears transmitting the motion from the longitudinal to the cross shaft being housed in an oil-tight gear-box, this box being so arranged that the operator may replenish it with oil when required through a feed placed within easy access in front of the smoke-box.—See Figs. 3 and 4.

It will be noticed that the drive of this cross shaft is taken from the intermediate wheels and consists merely of a pair of bevel wheels, one of which is keyed to the axle and the other to the end of the driving shaft, the former wheel having thirty-six teeth and the latter twenty-five teeth. This gear-box is also filled with oil, and should not require attention for a lengthy period. Here, again, provision is made for replenishing should it be required.

The longitudinal shaft is provided with five splines to allow for telescopic motion, and a universal joint is fitted halfway up the longitudinal shaft to allow for the rise and fall of the engine. A coupling is now provided on the longitudinal driving shaft at the end nearest the gear-box on the wheel axle, in order to facilitate the removal of wheels and axle in the event of a hot axle-box being experienced.

Reversing is controlled by a wheel on the footplate. By rotating this wheel through 326 deg. the gear is changed from "full forward" to "full back." The wheel can easily be turned with one hand.

As an indication of the attention required as regards lubrication, the bevel gear drive on the intermediate axle may be taken. An examination was made after the engine had run 10,000 miles and oil replenished to the correct working level. No further attention was given until the engine had run 17,000 miles, when one pint of oil was added to the gear-box.

As regards running maintenance during the period, August 1st, 1926, to September 18th, 1927, the engine was attended to only five times at the running sheds, as against twenty-four times for the standard engine 5917.

A hydrostatic lubricator is used for the cylinder lubrication with one feed per cylinder. The feed in each case enters the cylinder midway between each end of the stroke and as near the top of the cylinder barrel as possible. The lubricator is arranged so that all feeds may be shut off by the operator without interference with the individual oil supply regulating valves. No lubrication is provided for the valve stems.

Engine No. 5908, "Claughton" class, was fitted up with this gear and went into traffic in August, 1926, since when she has been working express passenger trains between Crewe, Carlisle and Euston. Trials were carried out in January, 1927, with the results shown in the tables. At the end of last year this engine had completed a mileage of 48,478. The standard "Claughton" engine No. 5917, which was put into traffic on the same date, and ran trials against 5908 in January and February last, had completed a mileage of 42,886.

Coal Consumption from January 1st to September 18th, 1927.

	Miles.	Coal. T.	c.	lb. per mile.
Engine No. 5908	33,543 ..	692	0 ..	46·212*
Engine No. 5917	31,970 ..	832	7 ..	58·319*

* Including lighting up and shed duties.

Engine No. 5908 ("Caprotti" engine) shows an economy of 20·76 per cent. over the standard "Claughton" No. 5917. Assuming that the mileage is equalised the "Caprotti" engine shows a saving of 181 tons 6 cwt., approximately 241 tons per annum.

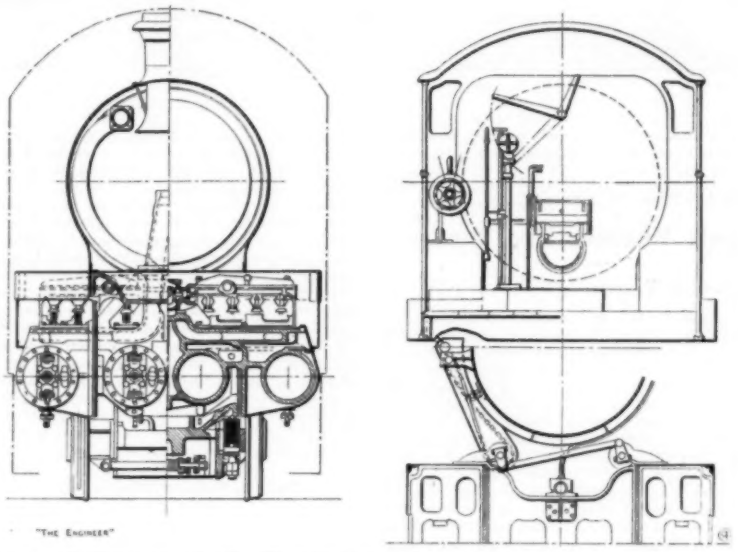


FIG. 4—END VIEWS AND CROSS SECTIONS SHOWING ARRANGEMENT OF CAPROTTI GEAR

Oil Consumption from August 1st, 1926, to September 18th, 1927.

	Cylinder, pints.	Motion, pints.	Mileage.
Engine 5908	900 ..	1,657 ..	48,478
Engine 5917	1,620 ..	1,879 ..	42,886

Consumption in pints per 100 miles.

	Cylinder.	Motion.
Engine 5908	1·856	3·418*
Engine 5917	3·777	4·384*

* Including shed duties.

Assuming the mileage is equalised :—

	Cylinder, pints.	Motion, pints.	Mileage.
Engine 5908	900 ..	1,657 ..	48,478
Engine 5917	1,831 ..	2,124 ..	48,478

Engine 5908 shows a saving of 931 pints of cylinder oil on standard engine 5917, or 50·8 per cent.

Engine 5908 shows a saving of 467 pints of motion oil on standard engine 5917, or 21·98 per cent.

In addition to the saving in coal and water, it has been noted that the shed maintenance is reduced, which, of course, is a direct result of the reductions in number of motion pin joints and the elimination of valve spindle packings.

With regard to lubrication, this is considerably simplified, as the working parts of the Caprotti valve gear are encased in oil baths, which results in economy.

The inlet steam and exhaust valves fitted to the cylinders are so arranged that when the engine is drifting they act as very efficient by-pass valves, and therefore excessve compression is done away with, thus resulting in a very free-running engine.

It should be noted that in the trial between Crewe and Carlisle on January 25th and 26th the return trip on the 26th was run in the early part of the great gale which swept England at that time.

We have to thank Sir Henry Fowler and Captain Beames for the particulars on which this article is founded.

WHAT IS YANKEE INGENUITY?

A UNIQUE problem, says the *Iron Age*, faces the Worcester Polytechnic Institute. Henry J. Fuller, of the Institute's class of 1895, has endowed a scholarship, the deed of gift specifying that it shall be awarded to the entering freshman who has exhibited the greatest amount of "Yankee ingenuity." It is a worth-while scholarship, for it will be enough to pay college tuition and other fees for the course and give the recipient an additional sum for other expenses. But what is "Yankee ingenuity," and what test shall be given the applicants to determine which is most worthy of the award?

The Institute authorities were puzzled and decided to seek counsel among engineers and executives. A group of fifty such men was selected and each was requested to submit a definition of "Yankee ingenuity" and to suggest a basis upon which candidates for the scholarship should be judged. Here are some of the definitions.

Ingenuity, according to modern usage, suggests an inventive power which is at once nimble and effective; a readiness in apprehending or devising new and effective means for the accomplishment of any given purpose.

Performance of an old stunt in a new and remarkably simplified way.

It is merely the application of good, old-fashioned common sense to the ordinary affairs of life and the most important factor in the correct solution.

It is closely allied to common or "horse" sense. A boy with common sense will find the simplest and the quickest way of accomplishing his purpose with the least expenditure of time and energy.

Yankee ingenuity is that quality of mind which enables the possessor to grasp a problem and to solve it in a manner at once simple, direct and practical as well as frequently surprising. Imagination, wit and common sense applied to the solution of problems mechanical or otherwise. The knack of solving difficulties.

Yankee ingenuity is, after all, just plain ingenuity, or the quintessence of ingenuity. Probably a good definition of ingenuity is cleverness and originality in designing something or in making something to fit the needs from the material one has.

Yankee ingenuity implies the inherent ability of solving a knotty problem in a simple and ingenious way, of accomplishing a difficult mechanical job without employing the customary tools. It implies cleverness rather than trained skill.

INTERNATIONAL CONGRESS ON BRIDGE AND STRUCTURAL ENGINEERING.

IN accordance with a resolution passed at the first International Congress on Bridge and Structural Engineering, which was held in September, 1926, at Zurich, Austrian civil engineers are preparing for a second Congress, which will take place in Vienna in the autumn of this year. It will begin on September 24th, with an opening ceremony at the Viennese Academy of Sciences, and be continued at the Technische Hochschule and at the Osterreichischer Ingenieur-und Architekten-Verein till September 27th. An International Committee, consisting of the following members of institutions of civil engineering, has been formed:—Mr. Lincoln Bush, President of the American Society of Civil Engineers, New York; Dr. Ing.e.h. R. Eggers, President of the Deutscher Eisenbau-Verband, Hamburg; Dr. Ing.e.h. Alfred Hüser, President of the Deutscher Betonverein, Oberkassel; Lieut.-Colonel J. Mitchel Moncrieff, President of the Institution of Structural Engineers, London; Monsieur R. Soreau, President of the Société des Ingénieurs Civils de France, Paris; Ing. Giuseppi Salvini, Secretary-General of the Sindicato Nazionale Fascista Ingegneri, Rome; and Dr. Ing. A. Rohn, President of the Schweizerischer Schulrat, Zurich.

The preparatory work and organisation is being carried out by the Congress Committee, with Professor Dr. Ing. Friedrich Hartmann—Technische Hochschule, Vienna—as President, Professor Dr. Ing. Rudolf Saliger—Technische Hochschule, Vienna—as Vice-president, and Dr. Ing. Friedrich Bleich, Vienna, as secretary. The President of the section for reinforced concrete structures is Oberbaurat Dr. Ing.h.e. Fitz Emperger, and the President of the section for steel structures Ministerialrat Ing. Friedrich Roth.

Profiting by the experiences of the first meeting, the Congress Committee decided to prepare a definite programme for the first two days, consisting of fundamental problems of steel and reinforced concrete constructions, as subjects meriting international discussion. The Committee has succeeded in getting as lecturers on these problems the names of experts, such as Messrs. Bohny, Sterkrade; Buhler, Bern; Bylander, London; Findeisen, Dresden; Fuller, U.S.A.; Gehler, Dresden; Godard, Paris; Hartmann, Vienna; Hawranek, Brünn, C.S.R.; Hübner, Bern; Kleinlogel, Darmstadt; Linton, Stockholm; Lossier, Argenteuil; Mendizabal, Madrid; Mörsch, Stuttgart; Ostenfeld, Copenhagen; Peña, Madrid; Pigeaud, Paris; Probst, Karlsruhe; Ros, Zurich; Saliger, Vienna; Spangenberg, Munich; and Streletzky, Moscow.

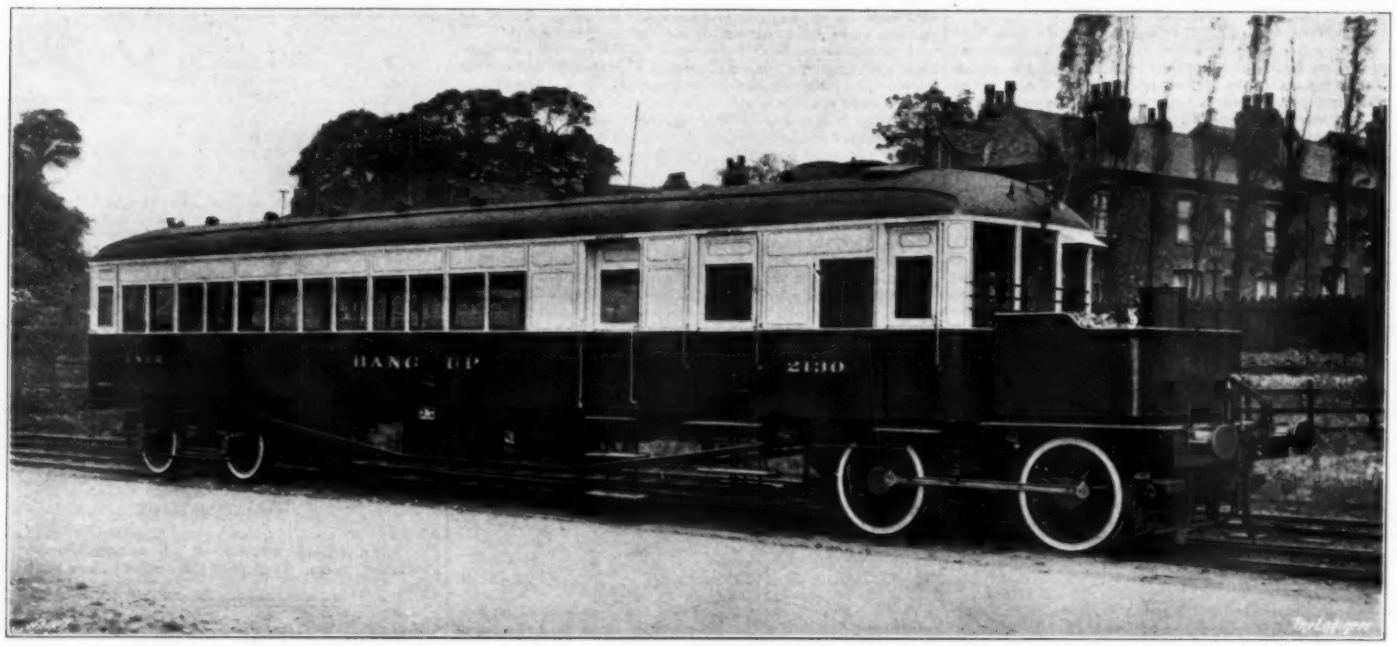
Beside these general conferences, sectional meetings are proposed in respect of which the programme has not yet been drawn up.

Further particulars may be obtained on application to the secretary, Internationale Tagung für Brückenbau und Hochbau, IV. Technische Hochschule, Vienna.

ONE of the many details that, quite unknown to the general public, were worked out, long before they were really required, in anticipation of possible hostilities, was the provision of ambulance trains, which were to be made up of converted bogie brake vans. Mr. C. A. Park and Mr. F. W. Marillier, the respective carriage superintendents of the London and North-Western and Great Western companies, were mainly responsible for their design, and when war broke out the necessary plans and instructions were already available. As related in THE ENGINEER of January 24th, 1919, the London and North-Western supplied the naval ambulance train within thirty hours of the receipt of the order on August 8th. We are reminded of that fact by the death on June 14th of Mr. Marillier, who, after forty-five years' service with the Great Western, latterly as carriage and wagon works manager at Swindon, retired at the end of 1920. Some particulars of the war material constructed under Mr. Marillier's supervision were given in THE ENGINEER of July 9th, 1920. One feature of which he was particularly proud was the mattress of his design supplied to the berths in the ambulance trains.

LONDON AND NORTH-EASTERN RAILWAY—NEW STEAM COACH

CLAYTON WAGONS, LIMITED, LINCOLN, ENGINEERS



Steam Coach.

ON Sunday last we had the pleasure of a run in one of the newest steam coaches made for the London and North-Eastern Railway by the Clayton Wagons, Limited, of Lincoln. And it *was* a pleasure, because, apart from any other consideration, the travelling was quite comfortable even at speeds above 50 miles per hour on a length of track which is so unimportant that it was torn up and sent to France during the war. We do not, of course, wish to disparage the permanent way, but the line in question cannot be compared to our main trunk lines, as it has curves as sharp as 3½ chains radius, and the company considers it necessary to limit the speed of ordinary trains running on it to 15 miles per hour when rounding the curves—and they are many. Nevertheless, the steam coach averaged a speed of 44 miles per hour on the outward journey and 42 miles on the way back. We took the opportunity of moving about from one place to another within the coach and found that even at the extreme ends it was difficult to believe, except with the aid of a stop watch, that such speeds were being maintained.

The coach, which we illustrate, is one of ten supplied to the railway company by these makers, and is peculiar in that the seating accommodation has been arranged according to Mr. Gresley's ideas to make the passengers comfortable for journeys of a length of up to, say, 100 miles, which is nearly the water carrying capacity of the vehicle. This rearrangement of the seats involves some loss of capacity, from sixty passengers to forty-four people, and is accounted for by the fact that all the seats face in the same direction instead of being alternatively *vis à vis* and unsymmetrical across the coach, but it is certainly much more pleasant. The coach is not merely a train for running occasionally between outlying stations, and could, if necessary, take its place in the schedules of a main line. It is, nevertheless, so furnished with steps that the passengers can mount or alight from the ballast level if there is not a station handy.

From a mechanical point of view there is not very much difference between this coach and the Clayton locomotive which we described and illustrated in our issue of April 8th, 1927. The boiler has, however, been slightly increased in size and now has a heating surface of 70 square feet, while there are 4¼ square feet of grate area. The working pressure is 275 lb. per square inch and the steam is superheated by about 100 deg. Fah. In this connection we noticed during the trial runs that a very steady head of steam was maintained and that the stoker had very little bother in keeping a good fire without black smoke.

The engine has two double-acting cylinders, 7in. in diameter by 10in. stroke, and is geared on to the driving axle with a ratio of 5 to 4. The valve chests are arranged beneath the cylinders in order to facilitate their drainage and obviate the use of the pet cocks on starting up. The valves have a lap which allows a cut-off of five-sixteenths of the stroke as a maximum, and we noticed that that was the position in which the link work was kept by the driver during practically the whole of the run. On only one occasion did he have to reverse to get his engine running, and we should imagine that such a manœuvre is very seldom required.

Both the bogies have a wheel base of 7ft. and they are spaced 42ft. 6in. apart between centres. One of them carries the complete driving unit and that end of the coach, while the other merely supports the opposite end of the body. At the engine end the floor of the coach is extended round about the boiler, so that the driver and his mate ride on that floor independently of the bogie beneath. The controls—that is to say, the throttle, link gear and brake—are duplicated at each end of the body so that the driver can run the coach from either end and the levers are made demountable to prevent the possibility of two people at opposite ends attempting to take control at one time.

Although the primary intention is that these coaches should be run as independent units, they are equipped with standard buffing and coupling gear, so that they can be run in a train and each of them is readily capable of drawing a trailer, of about the same seating capacity as itself, if necessary.

American Engineering News.

Powerful Shunting Engines.

On account of the great weight of trains which are pushed up to the "hump" in gravity sorting yards, some railways not only use large yard engines, but equip the tenders with steam bogies. This arrangement gives great increase in power without involving excessive size and weight of the locomotive. It also enables single trains of great length to be handled, thus avoiding the necessity of building additional tracks if more trains of fewer cars were operated. The Missouri Pacific Railway has yard engines of the 2–10–2 and "Mallet" 2–8–8–2 types with large tenders mounted on two six-wheel bogies. Each bogie has a horizontal two-cylinder engine geared to one axle and two of the axles are connected by coupling rods. The "Mallet" engines weigh 250 tons, while their tenders weigh 150 tons additional. The ten-coupled engines weigh 205 tons and have similar tenders. These tenders have underframes composed of a single steel casting, and they carry 18 gross tons of coal and 14,000 gallons of water. With these "auxiliary engines" the tractive power of the "Mallet" locomotives was increased from 94,400 lb. to 122,400 lb., while that of the ten-coupled locomotives was increased from 81,600 lb. to 111,600 lb. As the tender engines are not operated continuously for any great length of time the locomotive boilers have ample capacity to furnish the steam required. The trains handled weigh from 4500 to 5000 tons.

Proportioning Concrete by Weight.

For all its concrete roads the State Highway Commission of Iowa has adopted the practice of proportioning the aggregates by weight instead of by volume. As the strength depends upon the relation between the amount of solids in a given volume, and as the weights of the materials are proportional to the volumes of solid material in the concrete, it is considered logical to express the proportions by weight. This method also facilitates computations of quantities and the design of equivalent mixtures from dissimilar materials. Definite and constant proportioning of the successive batches is important, but in actual practice it is impossible to secure as accurate measurement by volume without very careful inspection and loss of time. With weighing it is easily possible to weigh to 5 lb. or less, and in an ordinary five-bag batch of 1 : 2 : 3½ concrete this would mean a possible error of only 0·3 per cent. If measured by volume in a box having an area of 6 square feet a variation of 1in. in height in filling the box would mean a possible error of 3½ per cent. The Iowa practice is to base the proportions on dry materials and to make simple moisture determinations about six times a day, correcting the weight of the batches accordingly. Another advantage is in having an accurate record of the amount of material used, as such materials are purchased by weight. Several varieties of weighing apparatus are used with success on the road construction work.

Mississippi River Control.

The regulation or control of flood waters in so mighty a river as the Mississippi is a difficult problem which has been placed before the engineering profession for solution, as a result of the great damage by flooding in the valley of the river. Unfortunately, there is lack of much-needed hydraulic information and records, while the project is also being made a football by political and interested influences. The American Engineering Council has recommended that the solution of the problem and the administration of the measures for river control should be in the hands of a board of eminent engineers to be appointed by the President and to have authority to appoint its chief engineer and staff. As a basis for any general plan of flood protection and river improvement there should be an economic survey of conditions in the flood affected region and a topographic survey of this region. Plans for specific diversion channels should wait upon complete topographic and hydraulic studies, and if hydraulic research laboratories they should be in charge of scientists appointed for long terms of service. Reforestation is not a practicable method of dealing with flood conditions on the Mississippi, but the cultivation of vegetable cover or other methods of controlling erosion may be a factor, in view of the sediment resulting from erosion on lands where vegetable cover has been destroyed or removed. Storage reservoirs on the head waters of tributaries would have a negligible effect upon the floods, as the floods result from rainfall along the drainage area far below the head waters.

A One-ton Open-hearth Furnace.

To determine the physical properties of new alloy steels it was desirable to make actual ingots and castings, as small melts of steel in a crucible from which test specimens could be made, were insufficient to determine the values of the steel in service. A 1-ton or 2000 lb. acid open-hearth furnace was built, therefore, by the Chrome Steel Works, following standard practice, but with some change in proportions necessitated by the small size. In particular, it had a considerably increased length in proportion to width in order to get proper flame propagation. The furnace chamber is 13ft. long and 3ft. wide with the basin 6½ft. long. The bottom is of regular acid-bottom sand. The charge, by hand, consists of about 1800 lb. of scrap and 200 lb. of pig. Alloy additions bring the charge up to about 2000 lb. of metal, and alloy losses are not greater than in a standard furnace. Both heat and carbon are held easily, the carbon being as low as 0·06 or even 0·04. Specifications are easily met. The furnace is oil fired with a consumption of 80 gallons per ton, vaporised by compressed air at 100 lb. pressure. This oil consumption is about double that of ordinary furnaces, owing to the greater heat losses in this small unit. Reversals are made every fifteen minutes. The average time from charging to tapping is four hours, and bottom pour is made with small ladles. The furnace man has the assistance of the regular pit gang in charging and tapping.

Steel for Aeroplane Construction.

Since the weight of an aeroplane without fuel, oil, crew, and paying load is from 50 to 65 per cent. of the total loaded weight, it is highly important to keep the structural weight low. In a paper before the American Institute of Metallurgical Engineers it was pointed out that the aircraft industry is engaged in research work on light-weight construction, and one notable result has been the building of reliable engines weighing as little as 2 lb. per horse-power. Until the development of welded steel fuselage it was considered poor design to use a weld where strength in tension is desired, but it is now realised that the monolithic character of a welded frame is an advantage and that welded joints to withstand tension may be efficient and reliable. Where metal can be used and light weight and stiffness are desirable, duralumin will be largely employed. It is sometimes used in tubular form, but generally in angles or channels bent from flat plates. Where welded joints are desired it is customary to use aluminium. Molybdenum alloy steel is promising, on account of ease of machining and heat treatment, and its high endurance under vibratory stress. Duralumin, on the other hand, has a low endurance limit and also a low resistance to corrosion. Stainless steels have advantages, but tend to corrode near welded connections. It is suggested that beryllium may become a commercial material. It is lighter than aluminium, non-corrodible, and stronger than mild steel.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Quiet Market Conditions.

THE iron and steel market in the Midlands and Staffordshire lacks animation. Demand continues quiet, and the price situation is uneventful. In many departments there is insufficient business being done to provide a real test as to values. Producers and consumers discuss business possibilities, but few transactions of any magnitude are negotiated. The Midland market is badly in need of a filip.

Steel.

Much satisfaction is expressed by engineers and consumers of steel in this area at the decision of the associated steel manufacturers not to further increase prices. It was known that there was some desire amongst producers to take an early opportunity to raise prices, but the chance of fighting the foreigner very nearly on equal terms evidently proved sufficiently weighty to counterbalance it. Many local steelmasters are in favour of a cautious policy, pointing out that at the moment there are unmistakable signs of improvement in sales of steel material. Native mills are getting an appreciable share of the orders which formerly were going abroad, which proportion is gradually increasing. The effect of higher continental prices is plainly visible from last month's trading returns, which show that while we imported nearly 16,000 tons less last month, we exported nearly 14,000 tons more. Ever since February a steady contraction in imports of iron and steel has been in progress, the tonnage having fallen in three months from 286,918 to 236,852. There was a pronounced fall last month in importations of half products. Steel ingots dropped from 8089 to 5137 tons of blooms, billets and slabs from 58,850, to 45,989 tons. Clearly there has been a substantial displacement of trade in favour of native producers. Higher continental prices have not only resulted in giving us a stronger competitive position in the home market, but have enabled us to get more business from abroad. There are rumours of a coming slump in continental prices. The interests which are joined in the continental cartel are reviewing the position, and the announcement of their policy is awaited with interest. The only change recently has been a rise of 1s. per ton on all sizes of plates. There is a good deal of foreign steel still coming into the district, but it is nearly all on old contracts. There has, however, been some speculative transactions in sheet bars and other descriptions of material. The amount of foreign constructional material being employed in the Midlands cannot very well be determined, but it appears to be restricted to light structures. There is but a moderate home demand for finished steel, but billets are in excellent demand. In addition to mild billets, a considerable quantity of high carbon are called for for the making of special steels. Steel scrap also sells well, the price remaining firm at £3 7s. 6d. delivered South Wales. Large quantities of steel strip are being absorbed by the tube mills.

Smelters' Anxious Time.

Blast-furnacemen are having an anxious time. The trade has been shaken by the reported action of some furnacemen in accepting extremely low prices for their stocks, and it is only with the greatest difficulty that prices are maintained, even at their present low level. The market is very quiet, demand being at a low ebb. Neither the foundries nor the forges are making any headway, and furnacemen who rely on those branches of industry for a market find themselves in a dilemma. Such opportunities of business as present themselves are immediately snapped up by those firms who do not hesitate to make price concessions, with the result that market stagnation threatens to become aggravated for the rest. It is increasingly clear that the market cannot absorb pig iron at the rate of output that has prevailed of late, and decisions to damp down till demand improves are almost expected. Indeed, it has been notified that the Cransley furnace at Kettering is to be damped down. The opportunity will, I understand, be taken to recondition it, and a companion furnace is to be held ready for rekindling as soon as business justifies it. South Staffordshire furnaces are producing cold-blast iron or basic for employment in district industries. Within their limits of their operations, there are sufficient openings for their output. Cleveland furnacemen are reported to be complaining that they are being undersold in the Scottish market by Midland competitors. Northamptonshire No. 3 foundry on 'Change in Birmingham to-day was procurable at £2 16s., though 6d. to 1s. per ton more was required for orders for small tonnages. Derbyshire foundry sold at from £3 to £3 2s., and North Staffordshire at £3 2s. 6d. per ton at furnaces. Forge irons are quoted Northamptonshire £2 13s. 6d., Derbyshire £2 18s. A few best irons are being sold for roll casting and high-class foundry work, but forge grades find hardly any purchasers.

Galvanised Sheets.

Galvanised corrugated sheets of 24 gauge have become firmer in price, and the minimum acceptable is now £13 7s. 6d. per ton f.o.b. Liverpool. Many Midland mills quote £13 10s., and some refuse to accept orders at below this figure, intimating to consumers that the increased cost of sheet bars makes this selling figure imperative if they are to get a profit on the transaction. Whilè the home market remains quiet, there has been an accession of orders from overseas, notably from the West Indies, South-West Africa and Australia. Most mills have considerably improved their order books during the past week or so, and there are prospects of additional business in the near future.

Staffordshire Bar Iron.

Mills engaged in rolling bars in Staffordshire report a shortage of orders despite the favourable terms at which their output can be purchased. Marked bar mills continue to run regularly, but only with difficulty, there being no weight of orders of makers' books. Values are maintained on the basis of £12 per ton. The disparity in quotations for Crown quality bars is unaltered. While Staffordshire ironmasters want £10 upwards, other outside producers offer supplies at £9 5s., or even less. There is, at the moment, very little call for this material. Nut and bolt iron and fencing iron is increasingly bought from local makers, Belgian No 3 bars, which are much utilised in this connection, being considered too dear. Staffordshire makers offer supplies at £8 17s. 6d., and it is reported some are prepared to accept slightly less. Wrought iron gas tube strip continues in good demand at £11 per ton. Increased annoyance is caused in this area by the large consignments of finished tubes still coming in from Germany, and which are superseding not only the work of the tube maker, but also of the iron and steel roller. Staffordshire ironmasters engaged in the re-rolling of steel are moderately employed.

Canal Bridges.

Midland manufacturers are keenly interested in the Bill now before Parliament dealing with the reconstruction and improvement and the future maintenance of canal bridges, and they were pleased to learn that at a meeting of the Association of Midland Local Authorities support for the Bill was forthcoming. Many of the bridges in this district are unsuitable for the heavily loaded transport lorries now in use, and some Black Country works find themselves in an impossible position—hemmed in as they are by these bridges—by reason of the notices which have been placed on them threatening actions and injunctions against firms which transport over the bridges a weight greater than that for which the structures were built. They can neither get material into the works nor finished goods out without ignoring the notices. The canal company is not under an obligation to reconstruct the bridges, the local authorities did not wish to take them over because of the enormous cost of reconstruction and maintenance, and the matter has come to an *impasse* with which the Bill, introduced by Colonel Windsor Clive, is designed to deal. With the support of the Ministry of Transport and other promised help, it is hoped to get the Bill through Parliament, and thus put an end to the impossible position which exists in many parts of the Midlands and in the Black Country in particular.

Coventry Machine Tools.

While the industrial position generally in Coventry leaves ample room for improvement and the local premier industry—that of motor car manufacture—is not as bright as it should be at this season, an improvement is discernible in various other trades carried on in the district. Particularly is this so as regards the important trade of machine tool manufacture. One of the largest firms engaged in this industry in Coventry is busier than it has ever been before, while other firms are doing extremely well. It is interesting to learn that the big volume of business now in hand is about equally divided between home and export. This call for tools from manufacturers at home would suggest an increase of work at the factories in the near future.

Midland Coalfields.

Pits in the Midland coalfields are working very irregularly, and it is obvious that the industry is in a bad way. Negotiations are proceeding between employers and miners in the Warwickshire coalfield as to the critical state of affairs. This week I have to record that notices to terminate their engagements have been served on many hundreds of miners in this area. It is reported that nearly 7000 Cannock Chase miners are without employment and many others are only doing a few days per week. News of the increase in exports of coal during the month of May have given rise to hopes that a continuance of the improvement may relieve the economic pressure on Midland coalfields. Miners' wages are down to the minimum, and the coalowners' position as viewed from the point of the increase in the deficit is a serious one. Anything which would tend to improve matters would be gladly welcomed.

Warwickshire Miners Given Notice.

Some 1200 miners employed at Exhall Colliery, Warwickshire, have received notices to terminate contracts, which will expire on July 4th. It is understood that over-production and the falling off in demand for coal is the cause. The management states that it intends to run one shift instead of two, and, further, that it is its intention to re-engage about half the men. At another Warwickshire pit, the Coventry Colliery, Keresley, 200 men have been given notice.

Unemployment.

Unemployment in the Midland area again shows an upward tendency, the latest total of 137,499 being an increase of 13,643 on that of the previous week. In the Birmingham area the number has advanced from 27,200 to 27,469, and at Coventry from 4503 to 4968. There have been slight decreases at Bilston, Tipton, Wednesbury, and Redditch, but in all the large towns increases are recorded. There are now out of work in the Stoke-on-Trent area 19,310; at Nottingham, 6083; Wolverhampton, 4316; Smethwick, 2956; Walsall, 5186; West Bromwich, 2608; Wednesbury, 2079; Tipton, 1801; Stourbridge and Brierley Hill, 2683; Oldbury, 1317; Northampton, 3086; Leicester, 7629; Dudley, 2627; Derby, 1894; Cradley Heath, 3554; Bilston, 2122; Redditch, 1710; Worcester, 1176; Peterborough, 537; and Leamington and Warwick, 632. Of the total, 139,146 are men, 33,615 women, 3699 boys, and 3039 girls.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Industrial Results.

A STRIKING decline in the profits of Platt Brothers, Ltd., of Oldham, manufacturers of textile machinery, is the most significant feature of the report for the year ended March 31st last. After providing for taxation, depreciation, and other charges, the net profits for the twelve months amounted only to £73,291, compared with £257,582 in the previous year, and £253,381 in 1925–26. The ordinary shareholders in the company received a dividend of 10 per cent. in each of the two last-mentioned years, but for the period covered by the present report the directors are unable to recommend the payment of any dividend on the ordinary shares, debenture interest and preference dividend being paid as usual. Messrs. Platt Brothers, it may be recalled, recently secured contracts to the value of over £500,000 for the supply of textile machinery to Russia, and an improvement in the financial results for the current year may be looked for. A contrast is provided by the report of Fawcett, Preston and Co., Ltd., engineers, of Liverpool, the net profits for the past twelve months amounting to £28,633, compared with a deficit for the previous year of just over £7000. The ordinary shareholders receive a final dividend of 10 per cent., making 15 per cent. for the year, compared with 2½ per cent. paid out of the dividend equalisation fund a year ago.

Mersey Tunnel Contracts.

The Mersey Tunnel Committee has placed the No. 2 contract, relating to the works under the river Mersey from the Liverpool to the Birkenhead side, with Edward Nuttall and Co., Ltd., of Trafford Park, Manchester, the contract price being £1,413,601. The same firm was the contractor for the No. 1 contract, which covered the driving of the tunnel, the cost of this section of the work, now approaching completion, amounting to £721,579. Another important contract in connection with the scheme is that for 50,000 tons of cast iron segments, which the Committee have placed with the Stanton Ironworks Company, Ltd., of Nottingham.

Fleetwood's New Slipway.

An official test of the new £25,000 slipway which the London, Midland and Scottish Railway Company have constructed near the entrance to the Wyre Dock, Fleetwood, has just been made. With the aid of the new slipway it will now be possible for the largest vessel which will use the port for fishing purposes to be drawn up. Two side-slipping berths, operated transversely from the main slipway, and enabling three ships to undergo repairs simultaneously, have also been constructed.

Coal Output Falling.

The steady decline in the production of the Lancashire, Cheshire and North Staffordshire coalfields during the past five years is disclosed by the Ministry of Mines report covering the first three months of the year. In the period referred to, the coal output in this area has shown a virtually persistent fall from 6,391,652 tons in the January–March quarter of 1924 to 5,252,704 tons in the same period of the present year; the number of workpeople employed showing a corresponding reduction from 137,245 to 112,086.

Non-ferrous Metals.

The further serious decline in tin during the past week, bringing the value at the moment of writing to not very much higher than £200 a ton, prompts the reflection that less than twelve months ago—at the beginning of last August to be precise—quotations were hovering round and actually touched £300, and that prices at the beginning of the present year were nearly £60 above the current value of £207 to £208 for cash metal. Tin has always been notorious among the non-ferrous metals for its ups and downs, but the above figures show that there is something inherently weak about the statistical position in this section of the market, for the decline since the "bulls" successfully hoisted the price up to £300 has persisted almost without interruption. The demand for copper has been quieter than usual, and here also there has been a further fall, both in standard metal and in refined. There has been some fluctuation in the case of lead, but on balance compared with a week ago, prices are about unchanged. Buying interest in this section has proceeded on quieter lines. Spelter is fractionally easier, and at the lower prices a slight spurt in the demand has been reported.

Iron.

Except for a slight shading here and there, there has been no marked weakening of foundry iron on this market during the past week. Current quotations for Staffordshire and Derbyshire makes, for delivery equal to Manchester, range from about 68s. 6d. to 70s. per ton, according to quantity, with North-East Coast iron at 79s.; Scotch at from 87s. to 88s.; and hematite at about 82s. 6d. per ton, including delivery in each case. Sellers have almost ceased trying to find explanations for the continued sluggish demand, and few of them are booking orders just now for anything but meagre quantities. Lack of confidence in prices may have something to do with the refusal of consumers to buy with their normal freedom, but there is growing up among sellers an almost fatalistic tendency to attribute the lack of buying interest to unsatisfactory trade conditions at the foundries. The demand for bar iron is on a very moderate scale, but prices in this section are still at £10 per ton for Lancashire-made Crown bars and 10s. per ton less for second quality materials.

Steel.

A rather interesting factor in the steel market here during the past few days has been a spurt in the demand for boiler plates from makers of Lancashire boilers,

a department which, for some time, has been buying very sparingly. Steel rollers, however, regard this as due merely to temporary conditions, and are pinning little hope upon a sustained demand from this direction. There is a certain amount of business passing in the same materials for locomotive builders. On the whole, constructional engineers in this part of the country are not unfavourably placed from the point of view of actual work on the books, and a fair number of inquiries are also circulating. The demand for constructional varieties of steel forms the bulk of the business on this market, and, in the aggregate, a moderate trade is being done. Joists and sections are at £7 17s. 6d. per ton; ship and tank plates at £8 12s. 6d.; boiler plates at £9 12s. 6d. to £9 17s. 6d.; large steel bars at £8 17s. 6d.; and small re-rolled sorts at £7 10s. to £7 15s. Imported steel is showing some indication of easiness after its steady advance, joists now being quoted at £6; Siemens plates at £8; wire rods at £6 15s.; billets at £5 7s. 6d. to £5 10s.; sheet bars at £5 12s. 6d.; angles at £6 10s. to £6 12s. 6d.; and steel bars at £6 15s.

Improved Outlook for a Manchester Firm.

Speaking at a meeting of the shareholders in Galloways, Ltd., Manchester, a few days ago, Mr. Henry Pilling, general manager, said that the firm was never busier than it was at present, preparing schemes, estimates and proposals for the rejuvenation of plant at an early date. All over the country, he said, firms had delayed so long in bringing their plant up to "concert pitch" and putting themselves into a position to meet foreign competition, that in many cases they could delay no longer, and it was evident that at an early date many of them would have to embark upon the capital expenditure necessary to put their plants in order. He saw evidence of this in the present state of the firm's order book. Mr. Pilling said that apart from any advantage that the "Supermiser" possessed it was going to revive, rejuvenate, and put on its feet again the Lancashire boiler as a steam producer. Several important orders for this appliance had been received, as well as an interesting order in connection with the closing of Baldwin's works in South Wales. The whole of the steam plant had been bought by the Australian Steel Corporation, and was about to be shipped to Australia. In the plant the steam pressure, originally 160 lb. per square inch, was to be raised to 250 lb., and the engine, of 20,000 horse-power, which was supplied by Galloways, had to be altered for that pressure. During the past year, Mr. Pilling said, Galloways had undertaken a large amount of repair work, and there were several important orders pending for new steam plants and rolling mill engines.

Manchester Association of Engineers.

On Saturday last the members of this Society, with their ladies, spent a very enjoyable afternoon, thanks to the hospitality of Mr. William G. Gass—President—at his charming home, the Hollins, Haulgh, Bolton, where he and Miss Gass gave a garden party. The weather was fine, and the many amusements and sports which were provided were much appreciated.

BARROW-IN-FURNESS.

Hematite.

There is little change in the state of the hematite pig iron trade in this district, and no change is expected at present. True, stocks will not accumulate at certain works in view of the fact that the steel departments, which are about to restart, will be taking a fair proportion of the output. Customers are wary of placing heavy orders, being still content to buy for immediate requirements. Trade with the Midlands continues to be the best. Scotch buyers are taking moderate quantities, and there are regular deliveries to Wales, but in no case does the tonnage stand high. The same remark applies to business with the Continent, which is steady but small. The iron ore trade is only fairly employed, and employment locally is not as good as it was in view of stoppages, complete and partial. Foreign ores are arriving in restricted quantity. The steel trade is likely to be busier. Workington will next week be producing rails and sleepers, and at Barrow steel works the rail mills, will be at work again after a rest of many months. The hoop works are still steadily employed and are likely to be.

Financial.

The debenture stockholders of the Barrow Hematite Steel Company have been circularised by the company asking them to give authority for the creation of £200,000 prior lien debentures and to grant a moratorium in respect of interest on debenture stock until December 31st, 1930, on the condition that all net profits gained by the company during the financial years 1928 to 1930 inclusive are utilised for the payment of such interest so far as such net profits will permit. The above concessions, the directors point out, would enable the company to tide over the difficulties which all companies engaged in the iron, steel and coal industries are at present undergoing. If the debenture holders fail to agree to the proposals; it is stated that there will be no alternative but a receivership, and this would destroy the company's valuable goodwill, and give rise to serious unemployment, as the company employs approximately 6000 hands.

SHEFFIELD.

(*From our own Correspondent.*)

Iron and Steel Trades.

THERE is no change in the general position of the local iron and steel trades. Business fluctuates a good deal, but in the aggregate there is no actual gain in the volume of orders coming into the city and district. This comment applies particularly to the crude iron and steel trades and to their heavy allied branches, and it is also becoming applicable to the medium and lighter industries. There is practically no forward buying of pig iron, and considerable stocks have accumulated at some of the furnaces. The ironfoundries are experiencing difficulty in getting orders, and as a result there is a tendency to cut prices in order to attract business. The production of open-hearth steel is at practically the same level as that noted recently, but an additional furnace has been started at the River Don Works of Vickers-Armstrong. This was one of three which were set down at Whitsuntide. The Lincolnshire iron and steel trades appear to be in a more flourishing condition than those of Sheffield and district. The greater proportion of the furnaces are working. The Frodingham works of the United Steel Companies are busy, but there is less activity at the adjoining Appleby Works of the same concern. Only one of the three big new furnaces there are operating, and the huge plate mill is only able to work part time. The continued depression in the steel industry has led to a number of firms in the East End of Sheffield embarking upon a policy of severe economy and retrenchment. A good deal of reorganisation of clerical and administrative staffs is going on, and many workers have come under the operation of the "axe."

Engineering Departments.

The heavy engineering shops are not finding it an easy matter to keep their plants working on profitable lines, but of late a slight improvement has been seen. The shortage of railway work is still noticeable, and this had made a big difference to several of the large firms which make a speciality of this class of work. The slump in the coal trade, too, has made a big difference to many local engineering firms. Colliery companies are being forced into a policy of severe retrenchment, and as a result Sheffield firms are losing a good deal of business in steel and engineering parts. It is interesting to learn that a firm in this district, the Stanton Coal and Iron Company, has secured the contract for the supply of the 50,000 tons of cast iron segments to be used in the construction of the Mersey Tunnel. There was considerable competition to obtain this contract.

Wire Rod Depression.

Interesting comments on current trade difficulties were made by Mr. H. C. Else in his speech as chairman at the annual meeting of William Cooke and Co., Ltd., Sheffield. He gave figures showing how the importation of wire rods and bar iron had grown, and how the company had had to accept reduced prices in order to obtain a share of trade. The wire rod mills had been most seriously affected—so much so that the company had closed its own mills for the time being, and had decided to take advantage of the Templeborough Rolling Mills, of which it owned a one-third share. Those mills were the most up to date in the country, and were proving that they could roll rods at a cheaper cost than any others. In May their output was nearly 5000 tons, and if that figure could be raised to 6000, there would be handsome profits for Cooke's. The wire ropery had worked very well, up to 93 per cent. of its capacity, but the fall in prices had been so enormous that it was impossible to make a commensurate profit. The fall in this case was not due to foreign competition, but simply to the competition of the makers in this country. Informative comments also appear in the report of Davy Brothers, Ltd., the well-known Sheffield engineering firm. The company's business continues to be adversely affected by the depression in the iron and steel industries, which up to the present time, states the report, show little sign of improvement. In spite of this, however, a larger volume of business has been secured during the last nine months of the financial year, which has materially improved the position and resulted in a small profit.

Electric Furnace Orders.

Steady progress is being made abroad in the melting of steel by the electrical process, and many inquiries are being received by furnace makers in this country. Mr. Greaves, of Watsons (Metallurgists), Ltd., is now in Russia directing an installation of a large Greaves-Etchells furnace. The firm is executing orders for two others, one of which, of 30-cwt. capacity, is for the New Zealand Government Railways, and is to be used for producing castings, while the other is a Watson rotating 5-cwt. furnace, to be supplied to a firm in India for melting brass.

Cutlery and Plate.

Business in the cutlery and plate industries is very irregular, but the general volume of trade appears to be on the increase, both for home and overseas markets. Several important contracts for shipping and hotel companies are in course of execution, and makers of silver table ware and good quality electro-plate report that they are doing a better trade in the home market. Very little business is passing in the once-profitable lines of pen and pocket knives and scissors, and these departments have had to be closed, one hopes only temporarily, in one or two of the large firms. Clarke, Shirley and Co., one of the oldest cutlery houses in Sheffield, have closed their factory and are transferring the business to Germiston, near Johannesburg. They concentrated for many years upon the production of cheap pocket knives for native use, South Africa being their main market, but finding it impossible to compete with the low German prices which have captured the bulk of the trade since the war, they have decided to remove their business to South Africa. A factory there has been equipped with plant from Sheffield, and Sheffield craftsmen have been engaged for the skilled processes. The firm anticipates that it will be able to offer the products of this factory at approximately the German prices, and it is also intended to develop the manufacture of other lines of cutlery.

An Italian Contract.

The François Cementation Company, Ltd., of Bentley, near Doncaster, which is well known for its work in sinking large pits, has secured a contract for strengthening the famous leaning Tower of Pisa. The order was obtained in the face of world competition, and after the firm, along with the principal specialists in this class of work in many countries, had conducted an examination of the structure. The tilt of the tower is not to be interfered with, the work being directed towards strengthening the foundations so that the building shall not develop a more pronounced tilt. The work, which at first will only be of an experimental nature, is to be begun at once. Shifting sand and gravel and running water are believed to be contributory causes to the very slow, but dangerous increase in the angle of the tower. The company's well-known cementation process will be employed. The manager of the firm states that it will charge only a nominal fee for the work, having regard to the architectural beauty and the historical fame of the tower.

Mechanical Coaling Plant.

A mechanical plant for coal locomotives at Cudworth, near Barnsley, is to be installed by the London and North-Eastern Railway. The plant consists of a hopper into which bottom-door wagons can be tipped. From the hopper a 1-ton conveyor will raise the coal and automatically deposit it into a 50-ton hopper bunker, from which coal supplies can be delivered into the engine tenders, as required. An emergency crane will be provided for use should the mechanical conveyor fail. At the same time, it is proposed to provide an electric motor to take the place of the existing steam pump which pumps the water required by the company for locomotives and for other purposes at Cudworth. The quantity of water pumped annually is about 32,000,000 gallons.

Artificial Silk Factory.

A contract for the building of a huge factory at Spondon, Derbyshire, for the British Celanese Company, has been placed with George Longden and Son, Ltd., of Neepsend, Sheffield. The factory is to be constructed on the most modern lines, and at least 1000 tons of steel in the form of reinforced bars will be necessary. This steel will be produced in the Sheffield district. The scheme is estimated to cost considerably more than £1,000,000. An interesting feature of the construction is that the whole building is to be on piled foundations, owing to the marshy nature of the ground, and thousands of piles will be used in the work. It is hoped that the factory will be completed in about a year.

NORTH OF ENGLAND.

(*From our own Correspondent.*)

Iron and Steel Trade Depression.

THE volume of business in the North of England iron and steel trade still leaves much to be desired. Output is severely restricted, there are still a great many idle furnaces, and exports are steadily dwindling. The outlook generally is regarded as quite gloomy. As a rule, little business is put through during the holiday months of July and August. This week over 400 men have been thrown temporarily out of employment as a result of the closing down of the Acklam Steel Mills of Dorman, Long and Co., Ltd., and part of the Clarence Ironworks owned by the same firm. It is hoped, however, that these will only be temporary expedients, and that the situation in the staple trade of the Cleveland district will improve sufficiently to permit an early resumption. At present there is more ground for anticipating this development at the steel mills than in the case of the ironworks. A lack of orders adequate to the requirements of these huge iron and steel manufacturing plants is responsible for the closing down of the mills. By the blowing out of the furnace at the Clarence Works the number of furnaces in operation on the North-East Coast has been reduced to thirty-four. The number in blast earlier in the present year was forty. It is understood, however, that the output of the furnace newly blown out will be more than counterbalanced by the increased production of another furnace hitherto working much below full capacity.

Cleveland Iron Trade.

The absence of any new feature makes the situation of the Cleveland pig iron trade far from encouraging, and, at the moment, consumers are not negotiating for quantities of iron commensurate even with the restricted output of the industry. The statistical strength of the industry, however, enables ironmasters to adhere to their fixed quotations, notwithstanding buyers' unwillingness to pay the prices asked. Stocks are low, and further reduction in output is expected. New business matures slowly and customers in Scotland are hesitating to accept full deliveries as they fall due under running contracts. Sales of comparatively cheap parcels of Northamptonshire foundry iron are reported to have been made to buyers north of the Tweed. No. 1 Cleveland foundry iron is 68s. 6d.; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; and No. 4 forge, 64s. 6d.

Hematite Pig Iron.

East Coast hematite pig iron is still in more than ample supply, and makers are hampered by rather heavy stocks, but sales have shown some slight improvement of late, and makers are inclined to take just a little firmer stand. Prices are not fixed, and are unsteady. Figures named are well below cost. Nominally, market rates are based on 69s. for mixed numbers. Customers claim that they can place orders on lower terms, but at least one firm of makers is holding out for the equivalent of 70s. for mixed numbers.

Ironmaking Materials.

The position as regards foreign ore is little altered. Continuation of the strike of ore miners in Sweden must shortly cause inconvenience in this district, though consumers have still supplies on hand, and are receiving occasional supplies from the stock at Lulea. Sellers maintain a firm attitude, best Rubio ore being quoted at 22s. 6d. per ton c.i.f. Tees. Moderate export sales of coke continue, and there are a few forward inquiries for home use, but local consumers are pursuing a very cautious

policy. Durham good average blast-furnace qualities are 17s. 6d. to 17s. 9d. per ton delivered at North-East Coast works.

Manufactured Iron and Steel.

Hope of early revival in the manufactured iron and steel trade is fading. Continental competition is not formidable, though there is some weakening of values of foreign materials. Overseas firms are reported to be well sold, and can only book orders for forward delivery. The situation abroad, however, is not diverting orders of moment to this district. Quotations are unchanged in every respect.

The Coal Trade.

The Northern coal trade, especially so far as Northumberland is concerned, is having a very difficult time in respect of competition at home and abroad. For long the county has been struggling against Polish rivalry, which has cut severely into the Scandinavian markets that were once dominated by Northumberland, and now the Yorkshire export bounty scheme threatens to take more trade from this district. The Swedish Vesteras Railways' order for 30,000 tons of steam coal, for which tenders were sent in by Northumberland collieries and merchants, has been placed for Yorkshire hards. The c.i.f. price is said to be 18s. 8½d. per ton, delivery to be from July to November—a figure very much below what was asked for Northumberland steams, the grade which for some years has been preferred by this company. Before the bounty plan, Yorkshire hards could not have been sold at anything like this price. The market has been under holiday influences this week, and business has been more or less in abeyance, merchants having covered all their requirements for the remainder of this month and the early days of July. Individual collieries are very differently situated in the matter of trade. Some are sold practically to full capacity for this year; others have disposed of much of their output into next year, it is said; and others, again, are wanting trade to avoid lost time. It is hard to account for the varying circumstances, and while trade on the surface appears very quiet, the volume of shipments from North-East Coast ports indicates that there has been considerable buying of almost all classes of fuel. For Northumberland steam coals fitters hold very steadily to the agreed minimum of 13s. 6d. for best qualities and 12s. for secondaries. Collieries are quite prepared to face idle time rather than any concessions, more especially as they contend that no additional business would be attracted for prompt at any cut prices. Durham steams are quietly steady, best grades 15s. to 15s. 6d., and best smalls 11s. to 11s. 6d. Durham gas coals offer abundantly, best qualities at 14s. 9d. to 15s., secondary 13s. 3d. to 13s. 6d., and special gas qualities 15s. to 15s. 6d. The continued steady inquiry is slowly hardening coke values. Gas coke, although fairly plentiful for early delivery, is quoted steadily, and forward sellers ask a firm 20s. to 21s. Patent oven cokes are firm, and show an improving trade at 18s. 3d. to 19s. Beehive and special cokes are firm at 24s. to 27s.

SCOTLAND.

(From our own Correspondent.)

Steel.

CONDITIONS in the steel trade have not changed appreciably during the past week. The volume of business is far below what is required to keep plants normally employed, and the absence of any indication of improvement deepens the existing depression. Some works have fair bookings, but such instances only serve to accentuate the poverty of others. Orders of large tonnage are extremely scarce, and a considerable proportion of the plants is either idle or operated intermittently. A fair amount of export inquiry is reported, but, unfortunately, the business resulting is meagre in the extreme. Heavy steel is on the whole unsatisfactory, and many mills could easily undertake a great many additional orders. Prices, however, are still unchanged.

Steel Sheets.

The market for steel sheets is not too satisfactory. The best qualities of sheets are comparatively well placed, but the cheaper descriptions have a very irregular demand. Galvanised sheets are not so firm as recently for export.

Iron.

The ironworks are no better off than the steel works, and there seems no reason to anticipate any early improvement in the depressing conditions which have characterised the iron trade for a considerable time back. Bar iron for home consumption still stands at £10 5s. per ton, despite the lack of business, but export might be done somewhat under the recent quotation of £9 15s. per ton. Re-rolled steel bars are little, if any, better off than iron bars, notwithstanding the "freeing" of prices. The home quotation is in the region of £7 5s. per ton, with export round about £7 per ton.

Pig Iron.

The demand for pig iron is weak and the prices realised are unsatisfactory. Consequently, a further reduction in output has been made, bringing the total number of furnaces in action down to twenty-seven. Prices are nominally unchanged.

Exports and Imports.

During the past week about 12,500 tons of iron ore and 2900 tons of iron and steel were discharged at Clyde docks. During the same period fully 3000 tons of iron and steel products were shipped to British Possessions, Japan, South America, Spain, and the United States. Pig iron shipments amounted to 626 tons.

Coal.

The result of Polish and German activities in the coal trade was amply borne out in the report submitted to Parliament by the Secretary of Mines, which included the figures for Scotland. Since the beginning of 1925, 236 Scottish pits have been closed. Of these, 150 are situated in Lanarkshire, 47 in Ayrshire, 29 in Fifeshire and 10 in the Lothians. Furthermore, there does not seem to be reasonable grounds to anticipate an early change in the ruling conditions. The collieries' scheme to stabilise the market by a reduction of outputs did not secure the anticipated result, and the scheme has been amplified. A continued restriction of foreign demands and a seasonal drop in home requirements have reacted against the efforts of the collieries, and while production has been drastically reduced, supplies of most fuels are still sufficient to meet all requirements. A possible exception to the rule is Lanarkshire splints, which may become difficult to secure if exporters take up their commitments prior to the holidays. Lanarkshire ells and steams move steadily, and the same applies to Fifeshire and Lothian steams. The feature of the market at present is the firmness of washed nuts, which have become scarce, owing to the reduced production of large coal. Aggregate shipments during the past week amounted to 216,566 tons against 245,404 tons in the preceding week and 236,562 tons in the same week last year. The total decrease in shipments for this year to date, compared with the same period last year, amounts to 303,713 tons.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

STEAM coal trade conditions in this district have varied extremely little during the past week. It would scarcely be accurate to say that trade is perceptibly worse, though at the same time it is apparent to all that business has not improved, and that the conditions continue to be very dull not to say uninteresting. Despite this fact the returns of shipments for the week ended the 22nd showed a marked advance, as compared with the figures for the preceding week. The total came to 562,035 tons, which was 135,411 tons better than the quantity shipped the previous week, and was higher by 154,000 tons than the average weekly exports during the current year. It may be that owing to the system in force some of the shipments included in the figures for last week should rightly belong to the preceding week. However this may be, the improvement was a very welcome one, although the increased exports came about purely as the result of tonnage turning up, which had been fixed some time previously, and was not caused by a sudden spurt in business operations. It is interesting to note that the advance in exports last week was largely because of shipments to Italy and her possessions. The quantity was 127,800 tons, compared with 81,073 tons in the previous week. On the other hand, shipments to France were down from 125,116 tons to 102,946 tons. It appears improbable that last week's improvement will be maintained, as at the end of last week the total of idle loading appliances at the various ports was as high as forty-four, though, as the result of arrivals over the week-end, this figure was reduced to just over thirty. Still this level of idle appliances is altogether too high and means very considerable inactivity at the docks and reduced work at the collieries. Unfortunately outward chartering of late has to some extent fallen off instead of expanding, and while the current inquiry for supplies is comparatively unimportant, there are only two contract inquiries of any note on the market. One is for 90,000 tons of large coal for delivery from July to November on account of the Buenos Aires Great Southern Railway, and the other is for 20,000 tons of large coal for shipment over about the next three months for the Madrid, Zaragossa and Alicante Railway of Spain.

Spain and Coal Supplies.

It is reported that for some time past the Spanish coalowners, the Spanish Mining Council, and the coal merchants of Barcelona, have been negotiating an agreement whereby the merchants at that port are constituting themselves into a trust, which is to enter into a binding agreement with the Spanish coalowners regarding the quantity of coal to be imported annually into the Barcelona area. It is stated that this agreement has now been signed and that the coal merchants have undertaken to purchase from the Spanish collieries a quantity of coal which will be equivalent to 48 per cent. of the total coal requirements of the Barcelona area, excluding railway requirements. It is understood that a Royal Decree governing the matter will be issued during the present week.

South Wales Miners' Federation.

The annual conference of the South Wales Miners' Federation took place at Cardiff on Monday, but the proceedings were much on the lines of former conferences. A number of resolutions came up, some of which are quite hardy annuals. The balance sheet of the Federation showed an average membership for the past year of 72,981, compared with 136,250 in the previous year, and with 197,668 in 1920. Contributions of members amounted to £55,331, as against £37,916. The total value of the funds brought forward in to the 1927 accounts was £28,319, representing chiefly cash on current and deposit accounts, compared with £50,078 brought forward in 1925. The total expenditure last year was only £45,719, as against £368,593 in 1926.

Tin-plate Trade Council.

The annual meeting of the Joint Industrial Council of the Welsh Tin-plate Industry was held at Swansea, when Mr. H. C. Bond, the new chairman for the year, dealt with the position of the industry, and expressed gratification at the improved demand which would render unnecessary the operation of the scheme for restriction of output for at least the next three months. In the course of the proceedings the men's representatives submitted a claim for a revision of the sliding scale, and after discussion, the employers agreed to the appointment of a joint committee to consider the subject. The proposal was also put forward by the men that a scheme should be formulated for the provision of superannuation benefits for the workpeople. The employers said that they were willing to give consideration to any scheme the men might think fit to submit, and the men's side undertook to formulate a scheme.

Current Business.

There has been no revival in the current demand for steam coals, and the tone of the market is very dull. Only the best qualities of large coals appear to be experiencing any activity. These collieries are working very well, but such is not the case with other undertakings. A lot of time is being lost at a number of pits owing to the shortage of orders. This fact, of course, means the limitation of the quantity of small coals available for the market, and, as a consequence, smalls keep very steady in price. Coke and patent fuel continue to be featureless markets.

CONTRACTS.

W. DEDERICH, Ltd., informs us that the P.L.M. Railway of France has placed an order for sixty Dabeg pumps to be fitted to its locomotives.

THE STANTON IRONWORKS COMPANY, Ltd., near Nottingham, has secured a contract for over 50,000 tons of cast iron segments for the Mersey Tunnel.

THE STIRLING BOILER COMPANY, Ltd., has received from Olive and Partington, Ltd., of Glossop, an order for one Stirling five-drum water-tube boiler to evaporate 40,000 lb. of water per hour at a working pressure of 300 lb. per square inch. This order is an exact repeat of one placed last year, when two boilers of the same type were installed. Besides the boiler, the plant will consist of a superheater, steam receiver, economiser, stokers, plant, sub-structure, flooring and auxiliary equipment.

THE BRITISH SECHERON COMPANY, Ltd., asks us to state, with reference to the note which appeared under the heading "Contracts" in our issue of June 15th, that by an inadvertent clerical error in the information sent to us, it was reported that that company had received an order for a large Diesel-electric locomotive for Russia. The facts are that the order for the locomotive was given to the Hohenzollern A.G. für Lokomotivbau, of Dusseldorf, which placed the order for the electrical equipment of the engine with the British Secheron Company, Ltd.

LAUNCHES AND TRIAL TRIPS.

WATERTON, single-screw lake steamer; built by Sir W. G. Armstrong, Whitworth and Co., Ltd.; to the order of Mathews Steamship Company, Ltd.; dimensions, length 259ft. 6in., breadth 43ft. 6in.; to carry 2350 tons. Engines, triple-expansion, surface-condensing, pressure 200 lb. per square inch; trial trip, May 28th.

DELFINA MITRE, twin-screw motor train ferry; built by A. and J. Inglis, Ltd., to the order of Entre Rios Railways, Company, Ltd.; dimensions, 355ft. long, 57ft. 1in. broad, and 19ft. 9in. deep. Engines, eight-cylinder, four-stroke, single-acting, bore 400 mm. by 750 mm. stroke; constructed by Harland and Wolff, Ltd.; trial trip, May 29th.

DAYSPRING, twin-screw buoyage and survey vessel; built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of Crown Agents for the Colonies for the Government of Nigeria; dimensions, length, 190ft.; breadth, 36ft.; depth, 16ft. 6in. Engines, two triple-expansion, inverted, direct-acting, surface condensing, pressure 180 lb. per square inch; launch, May 30th.

JULIANA, twin-screw steam tank ship; built by Netherland Shipbuilding Company, to the order of Curacaosche Scheepvaart Maatschappij; dimensions, length, 305ft.; breadth, 50ft.; depth, 15ft. Engines, triple-expansion; constructed by Machinefabriek Gebrs. Stork & Co.; launch, June 2nd.

PASS OF BALLATER, oil tank steamer; built by Blythswood Shipbuilding Company, Ltd., to the order of Bulk Oil Steamship Company, Ltd.; dimensions, length, 200ft.; breadth, 30ft. 6in.; depth, 14ft.; to carry 860 tons deadweight. Engines, triple-expansion, 15in., 25½in. and 41in. diameter by 30in. stroke, pressure 180 lb. per square inch; constructed by Aitchison Blair, Ltd.; trial trip, June 2nd.

BANGALORE, single-screw steamer; built by Barclay, Curle and Co., Ltd., to the order of Hain Steamship Company, Ltd.; dimensions, length, 435ft.; breadth, 57ft. 4in.; depth, 32ft. 3in.; to carry 9200 tons. Engines, quadruple-expansion, 30½in., 44in., 63½in. and 91in. dia. by 57in. stroke, pressure 230 lb. per square inch; launch, June 5th.

CARPERBY, steamer; built by Wm. Gray and Co., Ltd.; to the order of Sir R. Ropner and Co., Ltd.; dimensions, length 418ft., breadth 53ft. 6in., depth 29ft. 5½in. Engines, triple-expansion, 26in., 43in., 71in. diameter by 48in. stroke, pressure 180 lb. per square inch; constructed by Central Marine Engine Works; trial trip, June 7th, 1928.

CABO SARDAO, single-screw tug and salvage steamer; built by Harland and Wolff, Ltd., to the order of McKie and Baxter, Ltd., for the Lisbon Harbour Board; dimensions, length, 120ft.; breadth, 25ft.; depth, 12ft. 6in. Engines, triple-expansion surface-condensing; trial trip, June 12th.

YAMANOTA, shallow draught oil tanker; built by Harland and Wolff, Ltd., to the order of Lago Shipping Company, Ltd. Dimensions, length, 315ft.; breadth, 50ft.; 2360 tons. Engines, twin screw, triple-expansion, 1100 H.P.; pressure, 180 lb. per square inch; trial trip, June 13th.

KING STEPHEN, motor cargo vessel; built by Harland and Wolff, Ltd., to the order of King Line, Ltd.; dimensions, length, 400ft.; breadth, 54ft. 6in.; depth, 34ft. 8in.; 5280 gross tonnage. Engines, six-cylinder, four-cycle, single-acting Diesel; trial trip, June 14th.

CITY OF LILLE, motor ship; built by Barclay, Curle and Co., Ltd., to the order of the Ellerman Lines, Ltd.; dimensions, length, 445ft.; breadth, 57ft. 9in.; depth, 33ft. 11in.; 10,300 tons. Engines, four-cylinder single-screw opposed piston, airless injection oil, 26½in. diameter by 53½in. stroke; trial trip, June 15th.

CRAGPOOL, steamer; built by Cowper Dry Docks and Shipbuilding Company, Ltd., to the order of Sir R. Ropner and Co., Ltd.; dimensions, length, 435ft.; breadth, 54ft.; depth, 29ft. 9in.; 9000 tons. Engines, triple-expansion, 26½in., 44in., and 73in diameter by 48in. stroke; launch, June 16th.

HONVED, steamship; built by Swan, Hunter and Wigham-Richardson, Ltd., to the order of the Hungarian Levant Steamship Company, Ltd.; 7500 tons. Engines, triple-expansion; trial trip, June 16th.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	19/- to 21/-
(1) Spanish	19/- to 21/-
(1) N. African	19/- to 21/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	22/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 14 0	—
No. 1 Foundry	3 15 0 to 3 16 0	—
No. 3 Foundry	3 10 0 to 3 11 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 9 0	3 9 0
No. 1	3 9 6	3 9 6
Cleveland—		
No. 1	3 8 6	3 8 6
Silicious Iron	3 8 6	3 8 6
No. 3 G.M.B.	3 6 0	3 6 0
No. 4 Foundry	3 5 0	3 5 0
No. 4 Forge	3 4 6	3 4 6
Mottled	3 4 0	3 4 0
White	3 4 0	3 4 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
,, ,, Foundry	3 2 6	—
(3) Northampton—		
Foundry No. 3	2 16 6 to 2 17 0	—
Forge	2 13 6	—
(3) Derbyshire—		
No. 3 Foundry	3 2 0 to 3 2 6	—
Forge	2 19 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 1 0	—
No. 4 Forge	2 18 6	—
Basic	3 0 0	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 1 0 (a)	—
	4 4 0 (b)	—
	4 7 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 5 0	—
Common Bars	10 5 0	—
Best Bars	10 15 0	—
LANCS.—		
Crown Bars	10 0 0	—
Second Quality Bars	9 10 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	10 10 0	—
Best Bars	11 0 0	—
Hoops	11 10 0 to 12 0 0	—
MIDLANDS—		
Crown Bars	9 5 0 to 10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 17 6 to 9 0 0	—
Gas Tube Strip	11 0 0	—

STEEL. (d)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ½in. and up	8 7 6	7 12 6
Sections	7 17 6	7 2 6
Steel Sheets, ¼in.	8 12 6	8 10 0
Sheets (Gal. Cor. 24 B.G.)	—	13 7 6

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 7 6	—
Angles	7 17 6	—
Boiler Plates	12 15 0	—
Joists	7 17 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	7 12 6	—
Soft Billets	6 15 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	7 10 0 to 10 0 0	—
MANCHESTER—		
Bars (Round)	8 17 6	—
,, (Small Round)	7 15 0	—
Hoops (Baling)	10 0 0	9 15 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 12 6	—
,, (Lancs. Boiler)	9 12 6 to 9 17 6	—
SHEFFIELD—		
Siemens Acid Billets	10 0 0	—
Hard Basic	7 2 6 to 7 12 6	—
Intermediate Basic	7 0 0	—
Soft Basic	6 5 0 to 6 7 6	—
Hoops	9 10 0 to 10 0 0	—
Soft Wire Rods	7 10 0	—
MIDLANDS—		
Small Rolled Bars	7 10 0 to 8 0 0	—
Billets and Sheet Bars	5 17 6 to 6 0 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 7 6 to 13 10 0	—
Angles	7 17 6	—
Joists	7 17 6	—
Tees	8 17 6	—
Bridge and Tank Plates	8 12 6	—
Boiler Plates	11 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/6 to 18/9
Block Tin (cash)	207 5 0
,, (three months)	204 17 6
Copper (cash)	62 18 9
,, (three months)	63 0 0
Spanish Lead (cash)	20 10 0
,, (three months)	20 13 9
Spelter (cash)	25 3 9
,, (three months)	25 1 3
MANCHESTER—	
Copper, Best Selected Ingots	67 15 0
,, Electrolytic	69 5 0
,, Strong Sheets	94 0 0
,, Tubes (Basis Price), lb.	0 1 1½
Brass Tubes (Basis Price), lb.	0 1 0
,, Condenser, lb.	0 1 2
Lead, English	22 2 6
,, Foreign	20 17 6
Spelter	25 7 6
Aluminium (per ton)	£107

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/7½ per lb.	
Ferro Tungsten	1/3 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£22 0 0	7/6
,, ,, 6 p.c. to 8 p.c. ,,	£21 15 0	7/-
,, ,, 8 p.c. to 10 p.c. ,,	£21 0 0	6/-
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£34 0 0	12/-
,, ,, ,, 1 p.c. carbon	£39 0 0	15/-
,, ,, ,, 0·70 p.c. carbon	£45 0 0	17/-
,, ,, ,, carbon free	1/1 per lb.	
Metallic Chromium	2/8 per lb.	
Ferro Manganese (per ton)	£13 10 0 for home £13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 15 0 scale 5/- per unit	
,, ,, 75 p.c.	£20 0 0 scale 6/- per unit	
,, Vanadium	14/3 per lb.	
,, Molybdenum	4/3 per lb.	
,, Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£170 to £175	
Ferro-Cobalt	9/3 per lb.	

FUELS.

SCOTLAND.
(Prices not stable.)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	13/9
,, ,, Ell	14/6
,, ,, Splint	16/3 to 17/-
,, ,, Trebles	12/6 to 13/-
,, ,, Doubles	12/6 to 12/9
,, ,, Singles	11/6
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/6
,, ,, Jewel	15/6
,, ,, Trebles	12/9
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	10/9 to 12/9
Screened Navigation	18/-
Trebles	12/6 to 12/9
Doubles	12/6 to 12/9
Singles	11/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	12/-
Secondary Steam	11/6
Trebles	12/6 to 13/-
Doubles	12/3 to 12/6
Singles	11/6 to 12/-

ENGLAND.

	Inland.
(8) N.W. COAST—	
Steams	24/- to 25/-
Household	37/6 to 50/-
Coke	22/6 to 23/6
NORTHUMBERLAND—	
Best Steams	13/3 to 13/6
Second Steams	11/9 to 12/-
Steam Smalls	9/- to 9/6
Unscreened	11/9 to 12/-
Household	21/- to 27/-
DURHAM—	
Best Gas	15/-
Second	13/3 to 13/9
Household	21/- to 27/-
Foundry Coke	18
SHEFFIELD—	
Best Hand-picked Branch	26/- to 27/6
Derbyshire Best Bright House	19/6 to 20/6 —
Best House Coal	18/6 to 20/- —
Screened House Coal	16/- to 17/- —
,, ,, Nuts	14/- to 15/6 —
Yorkshire Hards	14/- to 16/- —
Derbyshire Hards	14/- to 16/- —
Rough Slacks	8/6 to 9/6 —
Nutty Slacks	5/- to 6/- —
Smalls	3/- to 4/6 —
Blast-furnace Coke (Inland)	13/- at ovens —
Furnace and Foundry Coke (Export), f.o.b.	18/6 to 19/6

(9) SOUTH WALES.

	Export.
CARDIFF—	
Steam Coals:	
Best Smokeless Large	19/3 to 19/9
Second Smokeless Large	18/6 to 19/-
Best Dry Large	18/- to 18/9
Ordinary Dry Large	17/3 to 18/-
Best Black Vein Large	17/6 to 17/9
Western Valley Large	17/- to 17/3
Best Eastern Valley Large	16/6 to 17/3
Ordinary Eastern Valley Large	16/3 to 16/6
Best Steam Smalls	12/6 to 13/-
Ordinary Smalls	11/- to 12/6
Washed Nuts	17/- to 19/6
No. 3 Rhondda Large	19/6 to 20/-
,, ,, Smalls	14/- to 14/6
No. 2 ,, Large	16/- to 16/6
,, ,, Through	14/6 to 15/6
,, ,, Smalls	12/- to 13/-
Foundry Coke (export)	30/- to 37/6
Furnace Coke (export)	27/6 to 30/-
Patent Fuel	21/- to 22/-
Pitwood (ex ship)	26/9 to 27/3
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	32/- to 35/-
Seconds	24/6 to 27/6
Red Vein	20/6 to 27/-
Machine-made Cobbles	40/- to 43/-
Nuts	35/- to 43/-
Beans	23/6 to 26/9
Peas	17/9 to 19/-
Breaker Duff	8/- to 8/3
Rubbly Culm	11/- to 11/6
Steam Coals:	
Large	17/6 to 18/6
Seconds	16/- to 17/-
Smalls	10/- to 12/6
Cargo Through	15/- to 16/-

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our own Correspondent in Paris.)

The Steel Trade.

SINCE it was reported that the French and Belgian steel producers would ask for an increased production at the forthcoming meeting of the Steel Cartel at Dusseldorf, the situation has been changed by the strengthening of the fiscal protection in Spain and the United States and by the diminishing exports to Great Britain, whereby it is feared that there is a serious risk in relying upon an expansion of foreign trade. Moreover, it is impossible to foresee what will happen as the result of the monetary stabilisation, and in view of the uncertain outlook and of the opposition from Germany against any increase of steel production during the next quarter, it is now assumed that no change will be made. If the export trade is less active the situation on the home market has been improved by the negotiations now being carried out for the placing of orders on account of railway and other public works which are to be executed, partly with the aid of material supplied by Germany for reparations. As orders for material equivalent to one-half of the goods coming from Germany are to be placed in France the engineering trades, particularly, are assured of a fair amount of work. Thus inquiries are being made for the supply of accessory fittings for the continuous brakes for goods trains, the manufacture of which is to be undertaken equally in Germany and France. A further instalment of the Midi Railway electrification programme is also to be undertaken with German assistance. This comprises the electrification of 685 miles of line, thus bringing the length of the electrified lines up to 1200 miles, or about one-half of the whole system. The work will be spread over a period of five years. On the whole, the situation of the iron, steel and engineering trades is regarded as being relatively satisfactory, provided, of course, that prices of products and commodities are not further raised by the monetary stabilisation.

The Navy.

In reconstituting the navy, the programme was a modest one as compared with what has been done by some other countries, and the policy upon which it was based aimed at a definite and restricted object and appeared to be of an essentially defensive character. For the first time in the history of the French Navy the programme comprised the construction of a homogeneous fleet, and the ships were built to practically uniform types in a much shorter time than ever before. The designs and performances of the cruisers and destroyers have aroused general admiration. As the programme advances it is clear that the new navy is becoming stronger than it appeared likely to be. The armament is powerful enough for ships which depend largely for their defence upon mobility and speed. The radius of action is sufficient to enable the cruisers, destroyers and submarines to visit distant colonies without the necessity of intermediate bases. The Minister of Marine, Monsieur Georges Leygues, has organised a more efficient system of training by frequent cruises and visits to all the colonial ports. He is making the navy an attractive career both for officers and men, with the result that the deficiency of man power is being made good, and he has lately reorganised completely the rules and regulations by the issue of a new naval instruction book in which officers and men find everything for their guidance, both in home and foreign waters. The object of the Minister is to raise the general prestige of the navy.

Dredging the Seine.

With the aid of huge dredgers, supplied by Germany on account of reparations, the work of removing obstructions in the Seine and deepening the bed of the river is being proceeded with actively and, when completed, the normal level will be lowered by a foot through Paris and by 3ft. below Chatou. The obstructions consist of a number of small islands forming tortuous passages for the river, and those passages are being straightened by cutting away some parts of the islands and removing the soil to others. It is not intended to change the physiognomy of the Seine by removing more than is necessary, and it is expected that the straightening of the channels will be sufficient to ensure a free flow which will be accelerated by the important dredging operations between Bezons and Bougival. Farther down the river, near Andelys, about 60 miles from Paris, another series of small islands will be dealt with in the same way. Altogether about a million and a-half cubic metres of soil will be displaced by these operations.

Foreign Trade.

The returns for the first five months of the year show a restriction of foreign exchanges, while the values of imports exceed the exports. The imports were estimated at 21,626 million francs, a decline on the corresponding period of 1927 of 927 million francs. The exports totalled 21,035 million francs, a declension of 1388 million francs. As regards quantities the imports of "material necessary for industry," consisting partly of coal, amounted to 17,164,710 tons, or 1,538,516 tons less than during the first five months of last year. Notwithstanding this heavy decline there was an appreciable increase in the cost of the raw material imported. On the other hand, the exports of "material necessary for industry," in which steel products figure largely, totalled 13,867,530 tons, an increase of 1,277,302 tons, and the value diminished by no less than 1471 million francs.

Motor Ships.

After lagging a long way behind other countries in the building of oil-engined ships, the French yards have received a number of orders for motor ships during the past few months, including one from the Compagnie Générale Transatlantique for a ship of the "De Grasse" type, with Diesel engines, to be put into service between Havre and New York. It is also intended to use oil engines on vessels to be built for the South American service.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

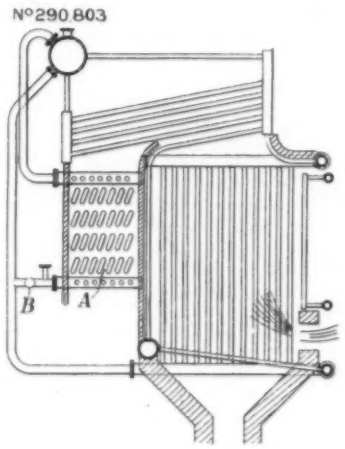
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

290,803. April 21st, 1927.—BOILERS AND ECONOMISERS, J. N. D. Heenan, Aldwych House, Aldwych, London.

One of the difficulties experienced with economisers in boiler installations is due to the fact that when the supply from the economiser to the steam drum of the boiler is throttled or interrupted, the economiser frequently generates steam which escapes through a blow-off or safety valve, and is lost. According to the invention, this waste is prevented by connecting the outlet header of the economiser direct to the steam space of the boiler and the inlet header direct to a downcomer from the water space of the boiler and interposing a non-return valve or equivalent device between the inlet header and the downcomer. The economiser A is arranged in a by-pass in the water circulating system of the boiler. Normally, the non-return valve B is

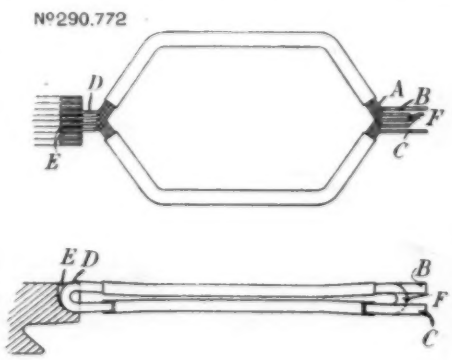


closed—that is to say, when feed water is entering and passing through the economiser—but when the feed-water supply is throttled or interrupted, a reduction of pressure is established on the economiser side of the valve and the latter opens under the influence of the head of water in the downcomer. In these circumstances a circuit is established from the outlet of the economiser to the steam space of the steam drum and by way of the downcomer from the water space of the steam drum, through the valve to the inlet of the economiser. Thus, if steam is generated in the economiser it will find its way, when the pressure reaches an appropriate value, into the steam drum and water will circulate. Instead of using a non-return valve in the connection between the downcomer and economiser inlet, a Venturi tube or nozzle may be interposed.—*May 24th*, 1928.

DYNAMOS AND MOTORS.

290,772. March 8th, 1927.—IMPROVEMENTS IN OR RELATING TO DYNAMO-ELECTRIC MACHINES, Robert Townend, of 17, Meadow-bank, Chorlton-cum-Hardy, Manchester, in the County of Lancaster, and Metropolitan-Vickers Electrical Company, Ltd., of 4, Central Buildings, in the City of Westminster.

The insulated strap conductor is formed in the case illustrated of four conductors, the sides being taped in the usual manner. The starting ends B and the finishing ends C are arranged adjacent to one another. The insulation is bared from the bends D and the convolutions and the bared bends are inserted

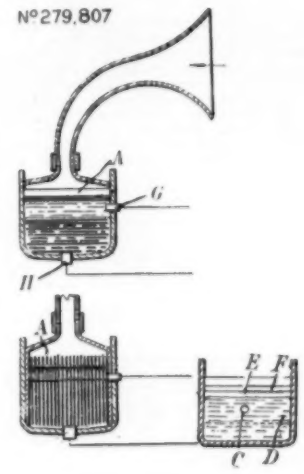


in slots E in the commutator bars or in the riders attached to the bars, and are brazed in the usual manner. In order to facilitate the coil to coil connections B and C, these connections may be arranged to protrude somewhat beyond the adjacent bend F of the intermediate convolutions of the coil are situated immediately adjacent to one another, instead of being slightly spaced apart, as shown in the upper illustration. Space is consequently left between the sides of the start B and the finish C of the coil and the bends F, so that there is room for clamps for clamping the start B and the finish C to the finish and start of other coils. The invention is only concerned with machines having more than two conductors per slot.—*May 24th*, 1928.

TELEGRAPHS AND TELEPHONES.

279,807. September 27th, 1927.—IMPROVEMENTS IN OR CONNECTED WITH MICROPHONES, LOUD SPEAKERS AND THE LIKE, *de Forest Phonofilms, Ltd., of 21, Denmark-street, London, W.C. 2.*

Loud speakers and microphones constructed in accordance with this invention are said to be free from any natural periodicity. The device consists of a casing connected to a horn. Within the casing there are insulating plates A with holes C. The case is filled with mercury, as indicated at D, and on the top of this there is a lighter liquid E, such as dilute acid. A

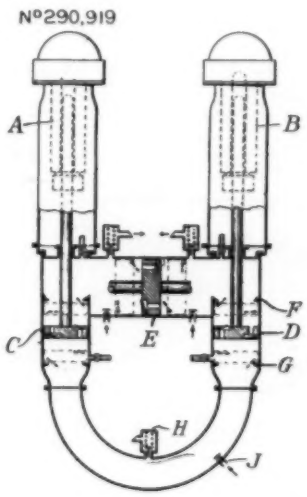


thin film of oil F prevents evaporation. Terminals G and H provide connection with the upper and lower liquids. The holes C are provided to insure an even distribution of the mercury between the plates and in the case of a loud speaker are connected to the output terminals of the receiving set.—*May 24th*, 1928.

PUMPING AND BLOWING MACHINERY.

290,919. November 30th, 1927.—HIGH-PRESSURE RECIPROCATING COMPRESSORS, Sulzer Frères Société Anonyme, Winterthur, Switzerland.

In this machine the compressor plungers A and B are operated by the pistons C and D, which, in turn, are worked by the piston E. The piston E is driven by a reciprocating engine, and transmits its movement to the pistons C and D hydraulically. The stroke of the piston E is, of course, determined by the prime

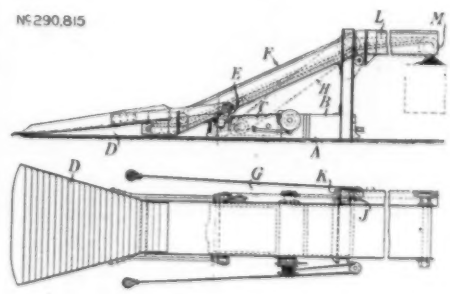


mover, while that of the pistons C and D is fixed by the stops F and G. The piston E has a slightly greater displacement volume than the others to make up for leakage. In order to prevent undue pressure in the hydraulic system at the ends of the strokes, each piston is provided with spring-loaded valves. There are also safety valves, such as H, on the connecting passages and connections J for making up loss of liquid.—*May 24th*, 1928.

CRANES AND CONVEYORS.

290,815. May 24th, 1928—SHOVEL DEVICE AND ELEVATOR APPARATUS, Mavor and Coulson, Ltd., S. M. Mavor and G. Dey, 47, Broad-street, Mile End, Glasgow.

The object of this invention is to provide new or improved apparatus comprising a power-operated shovel device and an elevator. A shovel device of the jigging or shaker type is pro-



vided and arranged to effect discharge rearwardly to an elevator of the type suitable for conveying material to a higher level, which ordinarily could not be done by jigging conveyors. For this purpose a conveyor of the scraper, band or other suitable kind is used. A body structure A formed with a skid base and comprising a motor at B and transmission mechanism at C,

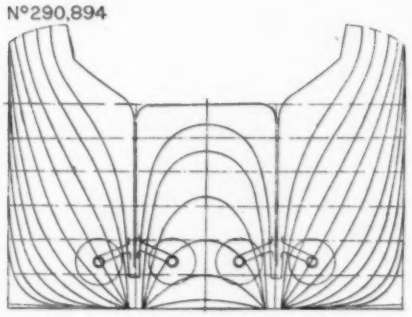
shovel D, rocking arms E by which the shovel D is reciprocated. The elevator F is a scraper conveyor. The driving system for F comprises a wheel G, chain H, wheel J, wheel K, chain L, and wheel M.—*May 24th*, 1928.

SHIPS AND BOATS.

290,894. October 10th, 1927.—SHIP'S FORM, T. N. S. Dickson, 6, Beechwood-drive, Jordanhill, Glasgow.

This invention has for an object to provide an improved ship form in conjunction with an arrangement of propellers applicable to all classes of war and merchant vessels with any type of stern, such that the resistance is reduced, the propelling efficiency is increased, and the steering and manœuvring capabilities and stability are improved. According to the invention, the after portion of the ship from a suitable position amidships is gradually subdivided longitudinally to constitute with a longitudinal

N°290,894



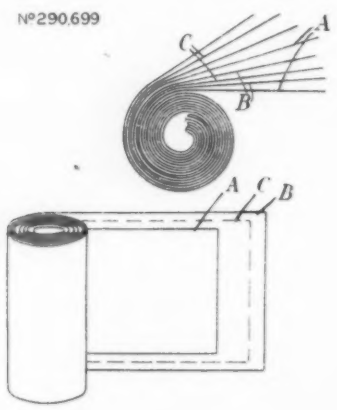
central channel "Siamese twin" after hull portions, each terminating at a sternpost, and a propeller is fitted at each side of each hull portion at the after end. As is understood, with the described arrangement, water flowing under the flat of the bottom may flow inwards and upwards into the space between the after hull portions and outwards and upwards outside each of these after hull portions at the after end, the propellers being fitted where the wake gain factor is at its highest and where maximum efficiency is maintained under ordinary working conditions.—*May 24th*, 1928.

MISCELLANEOUS.

290,699. January 19th, 1927.—IMPROVEMENTS IN OR RELATING TO THE DIELECTRICS OF CONDENSERS AND THE INSULATION OF CABLES AND OTHER CONDUCTORS, The Telegraph Condenser Company, Ltd., of Wales Farm-road, North Acton, and Sidney George Brown, of Western-avenue, North Acton.

The object of this invention is to provide means for preventing destructive ionising action in the dielectric of a spirally rolled condenser, in which the dielectric is divided into two or more layers by an isolated conducting layer. In the drawing, the

N°290,699

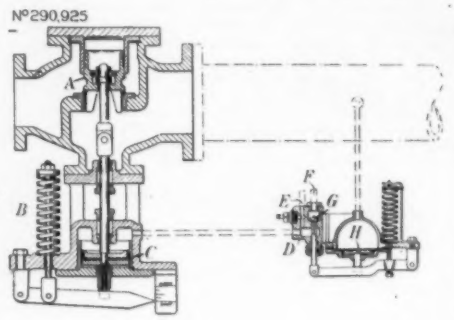


interleaved strips are shown partly unrolled. The usual active conducting strips are shown at A, and may be of metal foil separated by insulating strips. C are the isolated conducting strips rolled up with the other components of the condenser, and of such size that when rolled they are at least of the same extent in each direction as the active strips A. In the spirally rolled condenser shown, the isolated conducting strips have a greater width than the active conductor strips A. The specification also deals with the application of the invention to cables.—*January 19th*, 1927.

290,925. December 15th, 1927.—REDUCING VALVES, David Auld and Sons, Ltd., and J. Graham, Whitevale Foundry, Rochester-street, Glasgow.

This reducing valve is operated by a relay. The valve proper is shown at A and is of the equilbrium type. It is normally held open by the spring B. On the valve spindle there is a piston C, working in a cylinder in communication with the valve chest D, which is connected with a water supply E and a drain F. The valve G in the chest is controlled by the diaphragm H of the relay, which is subject to the lower steam pressure. Normally, the valve G remains open and the water runs to waste, but if the lower steam pressure rises the valve G closes and the water

N°290,925

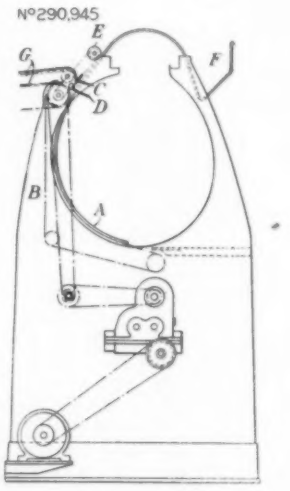


pressure acts on the piston C to close the main valve A.—*May 24th*, 1928.

290,945. September 9th, 1927.—PHOTO-COPYING MACHINES, J. Halden and Co., Ltd., Rowsley Works, Reddish, near Stockport, and J. B. Halden.

This invention is concerned with machines for making prints from tracings by the continuous method, and aims at delivering the print and the tracing separately. The two are carried round the glass printing chamber A, within which there is an arc lamp,

N°290,945



by the continuous blanket B. At the delivery point there is a V-shaped guide plate C and immediately below it there is a perforated suction pipe D. The print is naturally larger than the tracing, and it is consequently sucked to one side of the guide plate, while the tracing goes on, is fed forward by the roller E, and is caught in the tray F. The print is caught by another continuous blanket G and is delivered to the developing tank.—*May 24th*, 1928.

290,886. September 20th, 1927.—COMPOSITION FOR USE IN SUBSTITUTION OF ASPHALT AND BITUMINOUS MATERIALS AND FOR ELECTRICAL INSULATION, George Thomas Fuery, of 31–32, Newhall-chambers, 8, Newhall-street, Birmingham.

The object of the present invention is to provide a synthetic bituminous material capable of being produced at comparatively low cost, which will have wearing properties equivalent to those of natural asphalts. The material consists, basically, of a mixture of oil-bearing shale and tar. The oil shale used may consist of torbanite, tasmanite and petionite—shales obtainable in Australia—or other shale, while the tar may be of the vegetable, mineral or animal variety. It is preferred that the oil shale should be first pulverised in a suitable machine and subsequently incorporated with heated tar. The quantities of the two materials can vary, but the proportion of one part of tar to one and one-half parts of oil shale has been found satisfactory. The material obtained by mixing the two materials is used as a basis and is incorporated with selected materials for the production of road coverings, damp-courses for buildings and other composite materials. Satisfactory results have been obtained by mixing the basic bituminous material with one or more of the following filling materials, viz., ironstone, hematite, carborundum, coal, lignite, coke, slag, oil shale residues, shale coke, infusorial earth, magnesite, limestone—either burnt or unburnt—asbestos, cement, pumice stone, firestone, fire-clay, metal filings, chopped rubber, residual oil bitumen, ground glass, silicate of soda (water-glass), silicate of lime, potash, sawdust, cork, broken stone, sand, gravel, bauxite, and baryta. Other filling materials may also be used. The proportion of the filling material relative to the basic bituminous material will vary according to the product required, the particular filling material or materials used and the strength or resiliency or other properties desired. In experiments, an excellent road covering has been produced, containing 80 per cent. of ground limestone (unburnt) and 20 per cent. of the basic bituminous material. Satisfactory resilient paving materials have also been produced, using shredded waste rubber in approximately the same proportion of 80 per cent. For the production of electrical insulating materials, the basic bituminous material may be used, either alone or in combination with limestone or other dielectric substances. Insulating slabs or blocks suitable for use in mounting switches and electrical apparatus may be formed by moulding the material in suitable apparatus, while insulating tape and sheets may be manufactured by impregnating fabrics in the molten bituminous material.—*May 24th*, 1928.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MECHANICAL ENGINEERS.—Summer meeting at Southampton.

TO-DAY AND SATURDAY, JUNE 30TH.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—Summer meeting at Scottish Centre.

MONDAY, JULY 2ND.

ROYAL INSTITUTION.—21, Albemarle-street, W. 1. General meeting. 5 p.m.

FRIDAY, JULY 6TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—West Midland District meeting. Shire Hall, Shrewsbury. 2 p.m.

INSTITUTION OF SANITARY ENGINEERS.—Holborn Restaurant. Ordinary general meeting. 11.30 a.m.

SATURDAY, JULY 7TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—Visit to Messrs. Fletcher, Russell and Co.'s Palatine Works, Warrington. 3 p.m.

TUESDAY, JULY 10TH.

THE INSTITUTION OF ELECTRICAL ENGINEERS: SOUTH MIDLAND CENTRE.—Local summer meeting. Visit to the works of D.P. Battery Company, Ltd., Bakewell, Derbyshire; Haddon Hall; and the Derbyshire and Nottinghamshire Electric Power Company's outdoor sub-station, Ambergate. Assemble Grand Hotel, Birmingham, 8.50 a.m.

THURSDAY, JULY 12TH.

INSTITUTE OF PHYSICS.—The Institution of Electrical Engineers, Savoy-place, W.C 2. "Physics in Photography," by Mr. C. E. Kenneth Mees, D.Sc. 8 p.m.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE LONDON IRON AND STEEL EXCHANGE, Ltd., asks us to announce that its address has been changed from 123, Cannon-street, E.C. 4, to Imrie House, 33-36, King William-street, London, E.C. 4. Telephone, Central 7017.

VICKERS-ARMSTRONGS, Ltd., asks us to announce that Engineer-Captain William Onyon, M. Inst. C.E., has recently joined the staff of the company's establishment at Barrow-in-Furness in a consultative capacity, and will represent it in London.

AUTOMATIC AND ELECTRIC FURNACES, Ltd., asks us to announce that an agency arrangement has been concluded between it and Alfred Herbert, Ltd., of Coventry, for the sale of Wild-Barfield electric furnaces in the republics of Chili, Bolivia, and Peru.

W. DEDERICH, Ltd., of Stanley House, Dean Stanley-street, Westminster, S.W. 1, asks us to announce that it has taken over the representation of La Société d'Exploitation des Procédés Dabeg in Great Britain and India for the supply of the Dabeg locomotive feed-water heaters and economisers.

BROOK MOTORS, Ltd., Huddersfield, asks us to announce that it has taken offices at 73, Victoria-street, Bristol. Telephone number 8927. Mr. E. T. Oubridge will be in charge. The same company announces that as and from June 25th its Leicester address will be Allen House, Newarke-street. Telephone 3364.

REAVELL AND CO., Ltd., of Ipswich, ask us to announce that they have added to their directorate Mr. R. L. Quertier, B.Sc., Assoc. M. Inst. C.E., M.I. Mech. E., and Mr. Kingsley Reavell, A.M.I. Mech. E. Mr. R. L. Quertier has been manager of the London offices of the company for many years, and Mr. Kingsley Reavell is the son of the managing director, Mr. William Reavell.

A COMPANY has been formed under the title of British Benzol and Coal Distillation, Ltd., to install a Becker coke oven plant in accordance with a specification prepared by the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., together with a benzol rectification plant and a tar distillation plant, on a site leased from the Bedwas Navigation Colliery Company (1921), Ltd., at Bedwas, South Wales.

WE are informed by the Secretary of the Institution of Naval Architects that the Council of that Society has acquired the freehold of two houses in Adam-street, Adelphi-terrace, and has thus secured for the Institution a permanent home in the same neighbourhood as before. It is requested that, on and after July 1st, all correspondence should be addressed to Institution of Naval Architects, 2, Adam-street, Adelphi-terrace, London, W.C. 2.

END OF VOL. CXLV.

SITUATIONS WANTED (continued)

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ADVERTISER (21) SEEKS POST, Junior Estimating Draughtsman; 5 years' experience, rate, tank and pressure work; secondary and Technical college education.—Address, P4681, The Engineer Office. P4681 B

CONTRACTORS' AGENT (42), A.M. Inst. C.E., A.M.I. Mech. E., ex-Capt. R.E. (Tunnelling Coy., 4½ years' war service), just completed construction of high masonry and concrete dam, DESIRES POST. Experienced in the construction of masonry, concrete and earth dams, walls, headings, pipe lines and sewerage contracts, quarrying, light railway work, lay-out, erection and maintenance of plant for carrying out public works.—Address, P4682, The Engineer Office. P4682 B

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MISCELLANEOUS

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Continued from page 3.

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THE PROPRIETORS of BRITISH PATENTS Nos. 224,188, 226,745 and 230,330, all dated 23rd June, 1924, relating to "Crown Pulley Blocks or Frames," "Improvement in Travelling Pulley Blocks," and "Improvement in a Rotary Well Drilling Apparatus," respectively, are DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or OTHERWISE on reasonable terms for the purpose of EXPLOITING the above PATENTS and ensuring their practical working in Great Britain.—All inquiries to be address to B. SINGER, Steger Building, Chicago, Illinois. 8833 H

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THE PROPRIETOR of BRITISH PATENT No. 241,265, dated July 14, 1924, relating to "Improvements in Machines for Measuring Lengths of Fabric," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois. 8866 H

THE PROPRIETOR of BRITISH PATENT No. 237,915, dated July 30, 1924, relating to "Improvements in Oil Engines," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois. 8865 H

THE PROPRIETORS of BRITISH PATENT No. 223,553, dated 17th October, 1923, relating to "Engine" with Rotating Cylinders Arranged Radially," are DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to F. W. GOLBY, Patent Agent, 3, John-street, Bedford-row, London, W.C. 1. 8864 H

THE PROPRIETOR of BRITISH PATENT No. 150,507, dated July 29, 1919, relating to "Improvements relating to Apparatus for Measuring Off Lengths of Cloth and other Fabrics," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois. 8869 H

THE PROPRIETOR of BRITISH PATENT No. 235,413, dated July 28, 1924, pertaining to "Improvements relating to Walking Beams for Use in Connection with Wells," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago Illinois. 8871 H

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For continuation of Small Advertisements see page 82.

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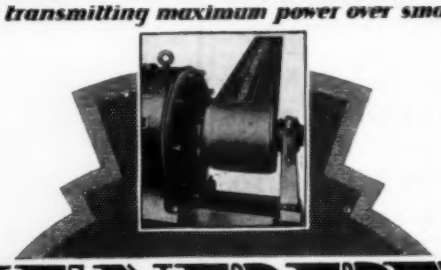

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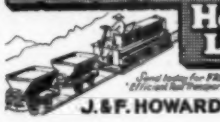

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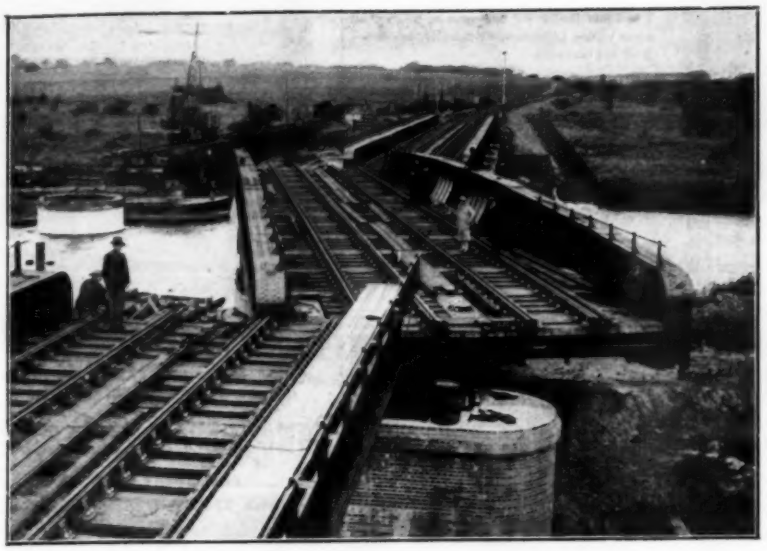

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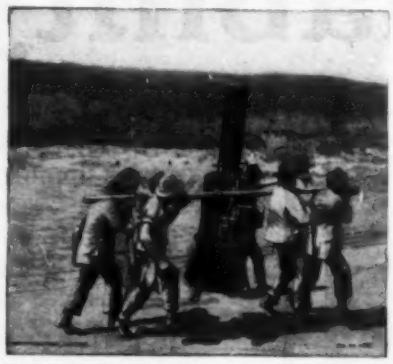
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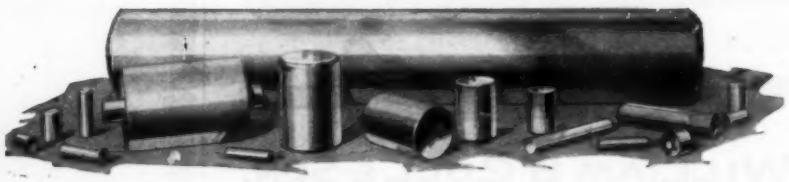

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Knowledge gained by a half-century's experience guides and controls the refining and blending of—

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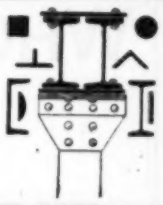

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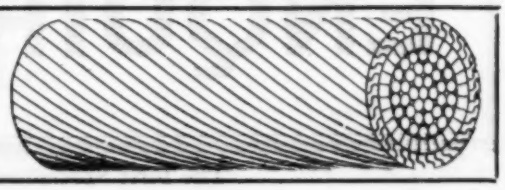

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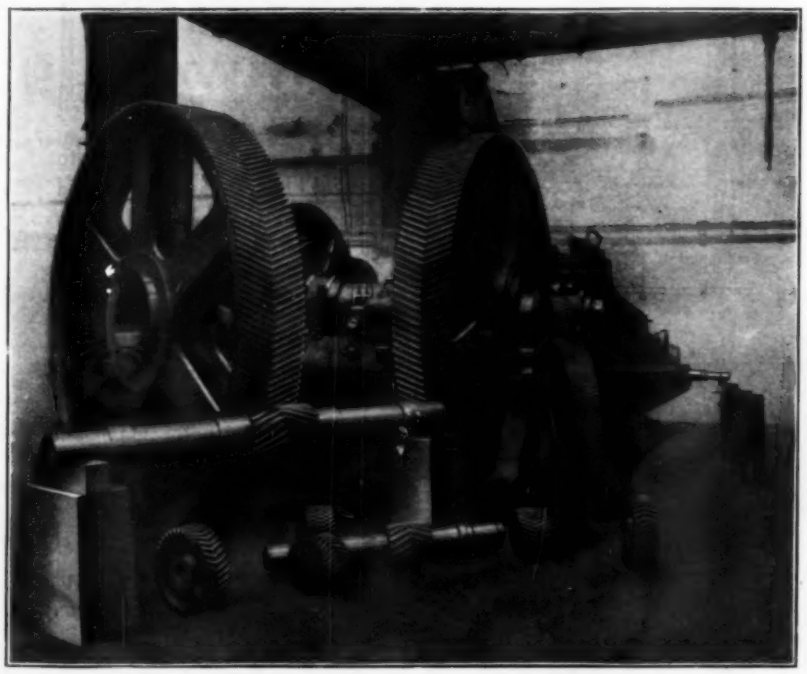

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ACCURATELY
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PROGRESSIVE
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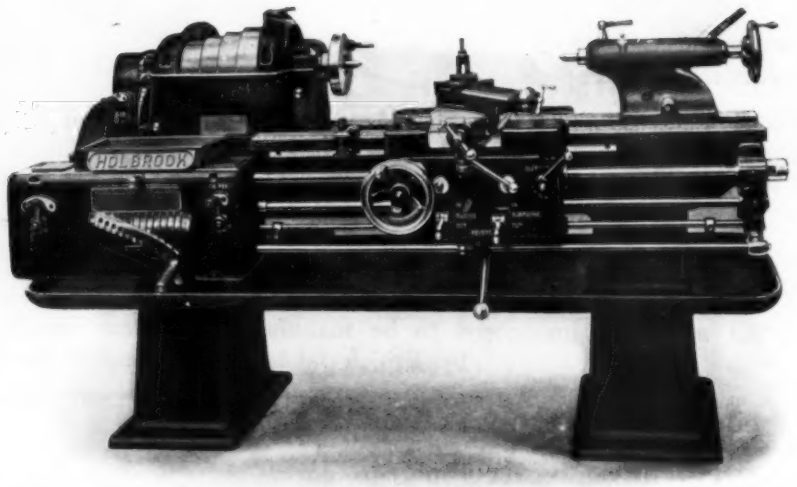

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Experience in worm gear production.

Concentration of worm gear manufacture in a specialised plant has been an important factor in the wonderful success achieved by worm gearing.

The worm drive is a delightful transmission — simple, quiet, efficient and durable—but it must be correctly made. Craftsmanship, plant and technical resources must be of the highest order. That is probably the reason why worm gear manufacture has gravitated naturally to the "DBS" gear plant at Huddersfield.

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Time is saved by purchasing complete drives from stock with the aid of the Renold Standard Drive Booklet.

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Delivered ready for installing in less time than it takes to quote on other transmission gear

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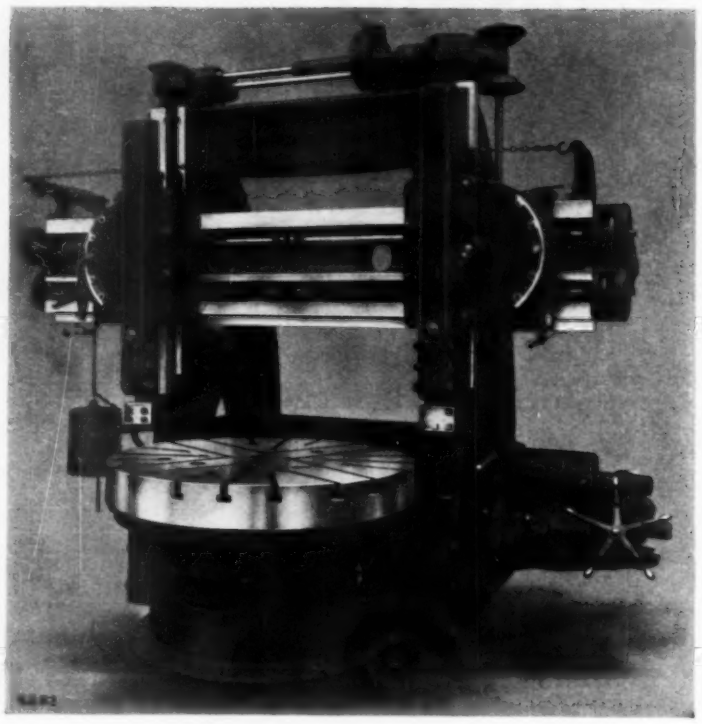

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VERTICAL.

BULLARD 24" "New Era" Turret Lathe, single pulley **(Reconditioned)** **£525**

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HORIZONTAL.

ZIMMERMANN No. ZB5 Boring, Drilling and Milling Machine, single pulley drive through gear box, 2" diameter spindle **(New)** **£325**

MUIR Size "A" Boring, Drilling, Tapping and Studding Machine, cone pulley drive, 2¼" diameter spindle **(As purchased)** **£135**

SOAG No. 75A (Lucas Type) Boring and Milling Machine, single pulley drive through gear box, 3" diameter spindle **(New)** **£450**

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(OFFERED SUBJECT TO PRIOR SALE.)

Less 2½% for cash carriage forward.

1500 Machine Tools in stock at Coventry.

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REMOVE YOUR ASH & SOOT AUTOMATICALLY

BY THE "USCO" SYSTEM.

ADVANTAGES ARE:

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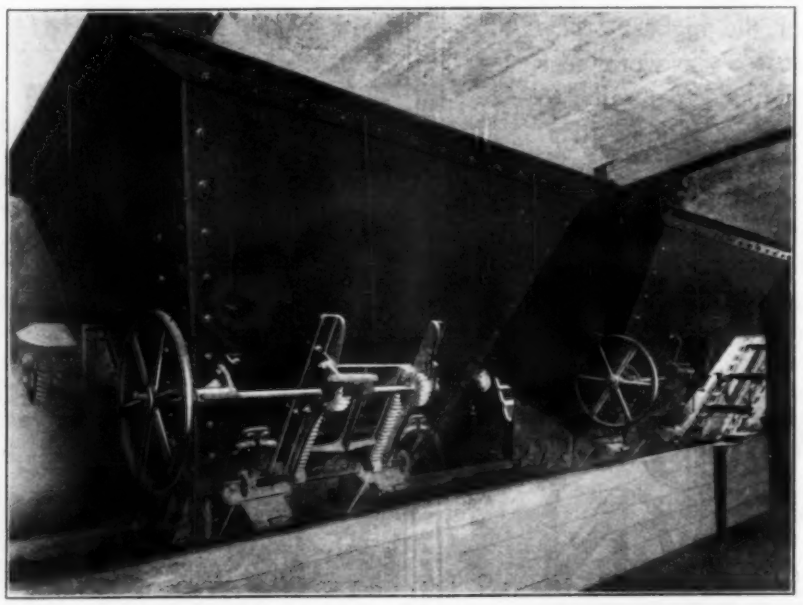

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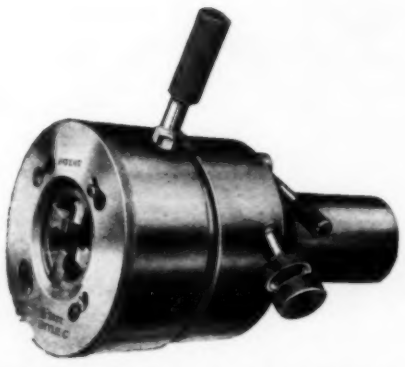

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For Standard Threads:—¼" to 4½"

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THE durability of Coventry Dies may be judged from the fact that after threading 180,000 of these pieces with a ⅝" Coventry Diehead the dies were reduced by only ·007" by regrinding.

Coventry Dieheads and Dies are made to a standard of quality and accuracy which ensures continuous good service.

The Diehead Specialist is always available to advise users on application and maintenance.

Ask him to demonstrate a Coventry Diehead on your own machines.

Copy of
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BRIDGE AND ENGINEERING COMPANY LTD TIPTON. STAFFS.

MANY of the world's most famous bridges are, in their strength and beauty of design, permanent and pleasing monuments to the superiority of Horseley Workmanship.

Such fine examples as Richmond Bridge, Kingston Bridge, and Hawarden Bridge are well known, and are typical of Horseley Bridges the world over.

The illustration shows the famous Swing Bridge at Littlehampton.

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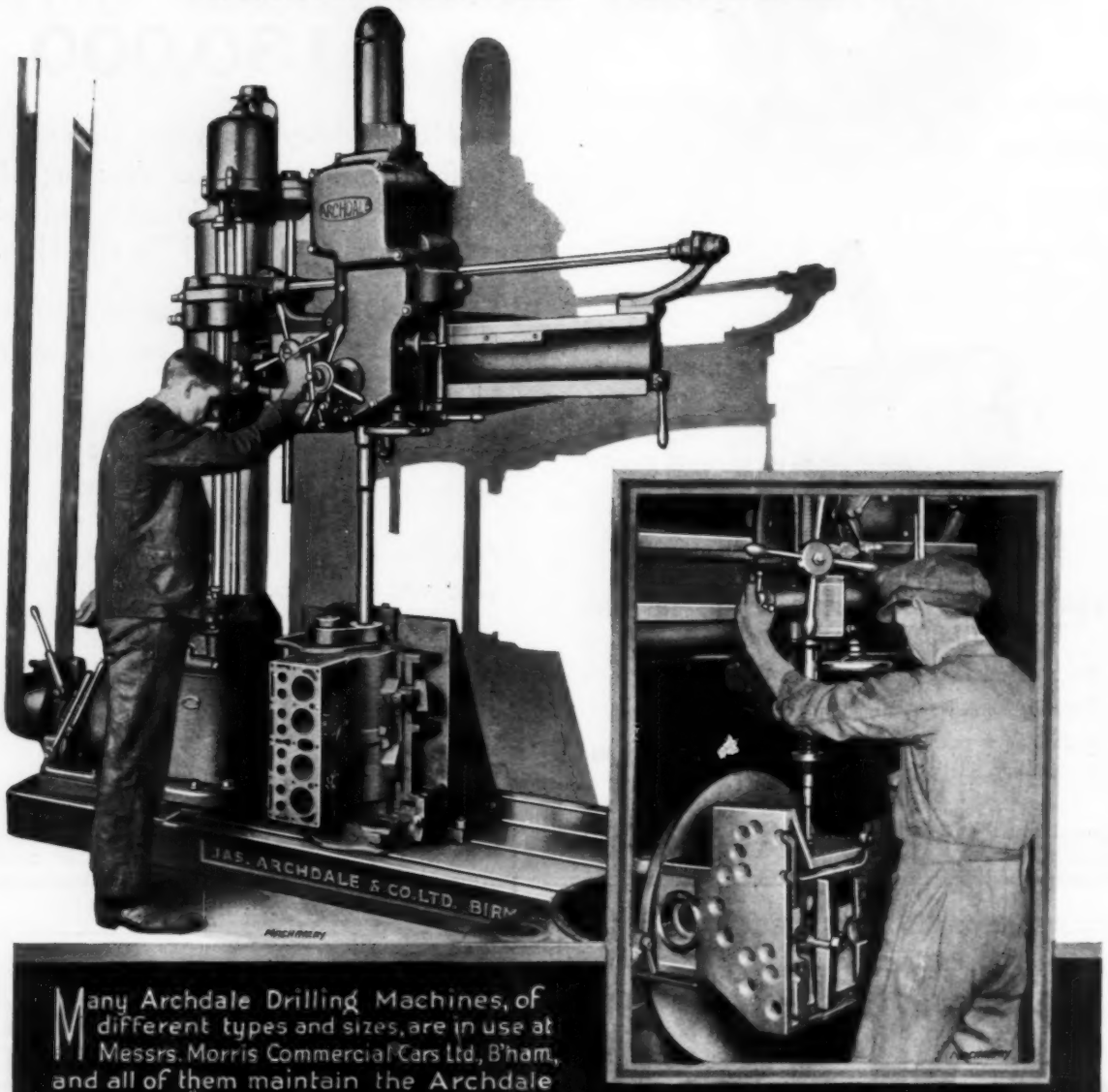
ASSOCIATED BRITISH MACHINE

17, GROSVENOR GARDENS

LONDON · GLASGOW · BIRMINGHAM

ARCHDALE DRILLING



Many Archdale Drilling Machines, of different types and sizes, are in use at Messrs. Morris Commercial Cars Ltd, B'ham, and all of them maintain the Archdale tradition for economical production.

The machines shown here are a 4'-6" Radial, rough-boring cylinder blocks for crankshaft journals and a 4ft. "Centralised-Control" and "Sensitive machine drilling and tapping 54 holes in different faces. Note the swivelling jig.

There's an ARCHDALE for your work too. — Ask us for particulars.

JAMES ARCHDALE & Co LTD., LEDSAM STREET, BIRMINGHAM.

"SUNDERLAND" GEAR PLANERS.

No. 11 Machine—
Capacity: 6ft. dia. × 10½in. face, 1¼ D.P.

No. 11 E Machine—
Capacity: 8ft. 6in. dia. × 10½in. face, 1¼ D.P.

Send for new list BB.4 of latest models.

J. Parkinson & Son
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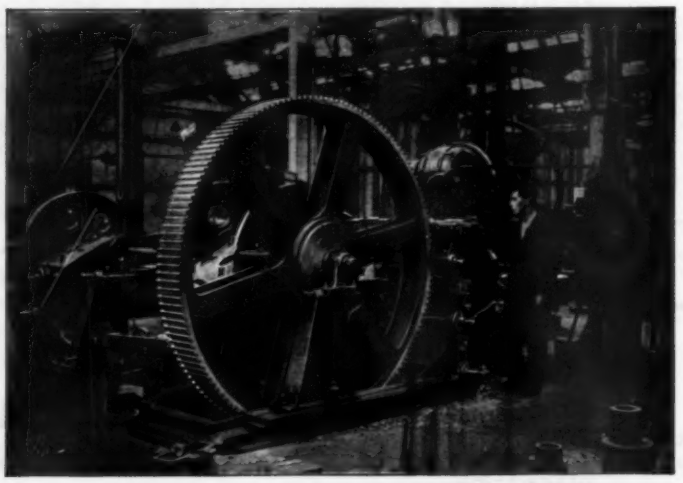

No. 11 E Machine cutting large gear in the works of the Reid Gear Co.

BRITISH BUILT MACHINES

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LONDON, S.W.1.

NEWCASTLE · PARIS · BRUSSELS · CALCUTTA

RICHARDS

Vertical Boring and Turning Mills,
Horizontal Surfacing Boring, Milling, Drilling and Tapping Machines,
Side Planers and Slot Drilling Machines
are all that modern machines should be.

SPEED with ACCURACY

is a characteristic feature of Richards Vertical Boring and Turning Mills. Their accuracy enables the machines adequately to meet the exacting demands of precision engineering, whilst their speed of output renders their installation essential when maximum production is required. That is why the 6ft machine shown is installed in the Finnieston, Glasgow, works of Messrs. Harland & Wolff, Ltd., by whose courtesy this photograph is reproduced

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2½" x 30"

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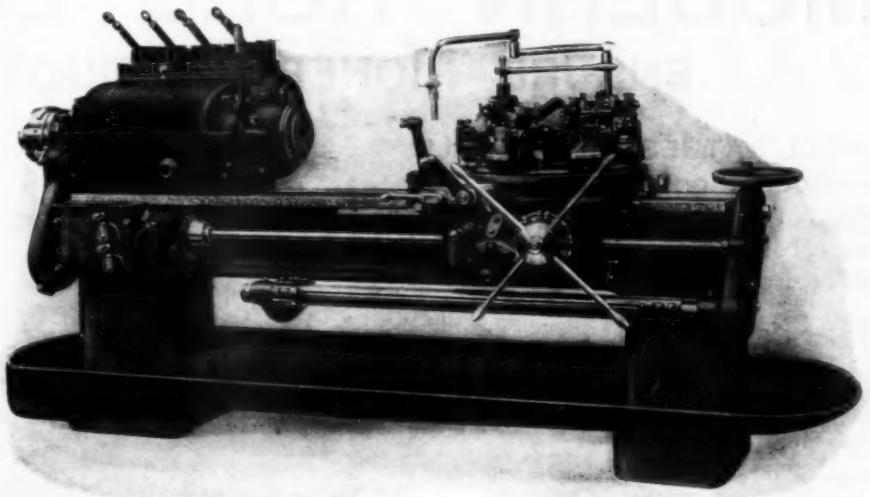
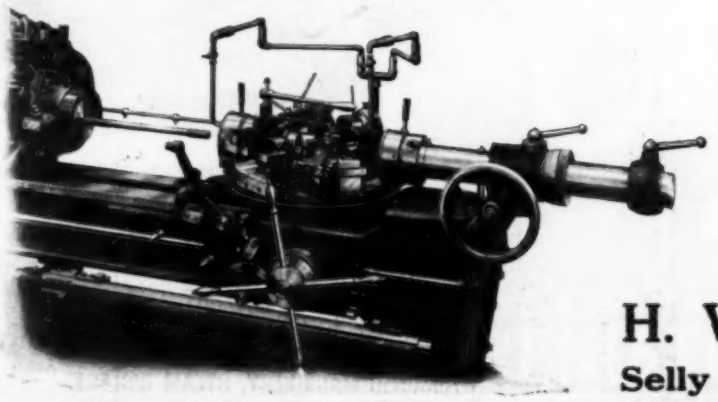
For all Bar Work.

Delivery from Stock.





For the Economical Production of Loco. Boiler Stays, fit it with a Stay-bolt attachment, illustrated herewith.

Full catalogues on application.

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THE BRITISH REMA

Mill and Vacuum System

PULVERISING PLANT FOR BOILER FIRING METALLURGICAL FURNACES, CEMENT KILNS, &c.

GRINDING PLANT FOR PHOSPHATES, BARYTES, BAUXITES, CHALK, CLAY, COLOURS, FOODSTUFFS, &c.

British Rema Grinding and Separating Plant provides highly efficient methods of producing powdered materials, at a greatly reduced cost. Cold air can be used during grinding, to cool substances such as rosin, whilst hot circulating air can be used during grinding, to dry substances containing a high percentage of moisture. There are few wearing parts, due to the original and simplified design, thus the cost of repairs and renewals is lower than with other systems.

Examine these claims by sending for full particulars, catalogues, etc.

We are makers of the British Rema Patented Ring Roll Mills, Beater Mills, Pinned Cage Mills, etc., and the Patented Vacuum System of air separation, and can supply machinery to produce powder of any grade, from 30 mesh to 300 mesh.

We shall be pleased to submit schemes for British Rema Plant direct, or in co operation with Consulting Engineers.

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MODERN ROLL LATHES

ENSURE HIGHER PRODUCTION.

Our NEW ROLL LATHES are designed to meet modern conditions. They save both time and effort and are built to give uninterrupted service, resulting in much improved production compared with the old-style lathe.

FEATURES:

Great strength and rigidity.

All gears machine-cut and contained in a totally-enclosed headstock.

Headstock made in three sections giving ready means of access to gears and bearings

All gears and bearings automatically lubricated.

Wide speed variation very easily effected.

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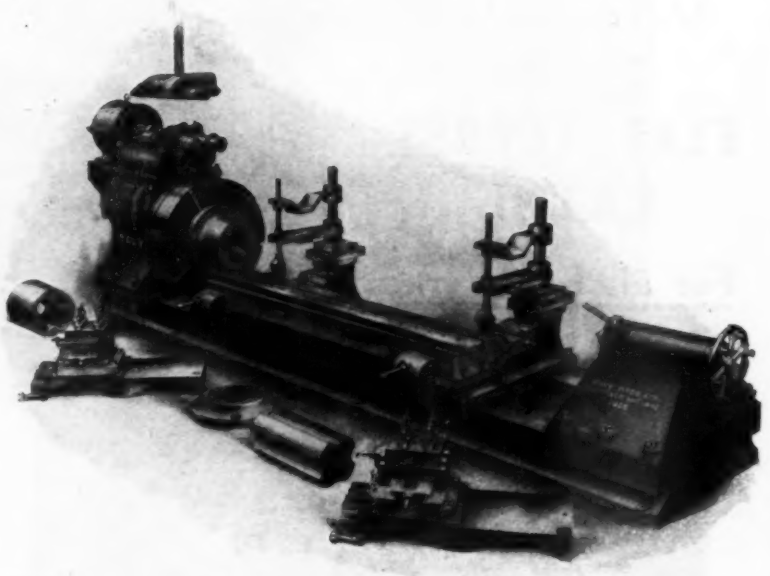
Provided with two necking rests of the compound slide type.

STANDARD SIZES

For rolls up to 18", 27", 36" and 48" dia.



36-in. ROLL LATHE.

We are also makers of :—

HIGH-SPEED FORGING PRESSES,
MODERN ROLLING MILL PLANT, INCLUDING
"MORGAN" CONTINUOUS MILLS,
STEELWORKS MACHINERY, STEAM HAMMERS,
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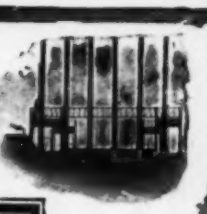

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Machine Shop in Shipyard, designed, constructed and erected by us.

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PIT RAILS.

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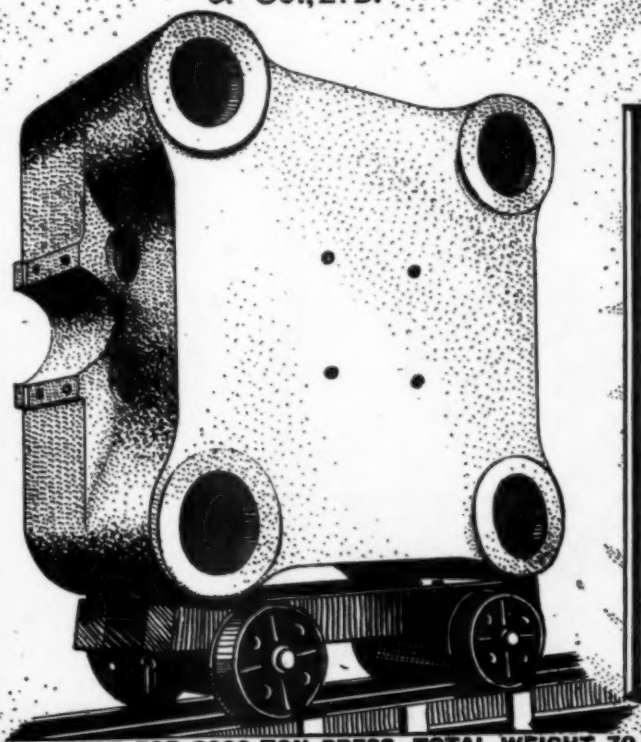
"H.R.D." HIGH SPEED STEEL FOR TURNING HARD TYRES, &c.



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New Series
No. 5

Vermin Proof

Unlike other non-metallic gear materials Fabroil is not attacked by vermin or white ants, and need not be specially packed for storage or transport.

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Tropical climates and sea air have no effect on this material, which will retain its shock absorbing qualities under all conditions.

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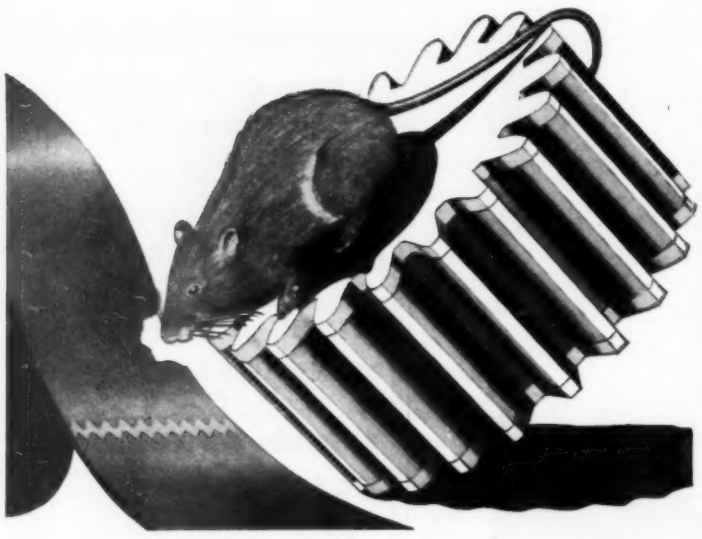
Further advantageous properties of Fabroil will be dealt with in subsequent advertisements of this series.

For full particulars please write for Descriptive List 2531.



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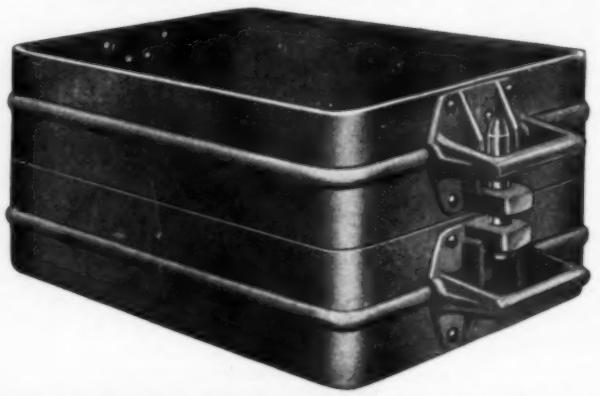

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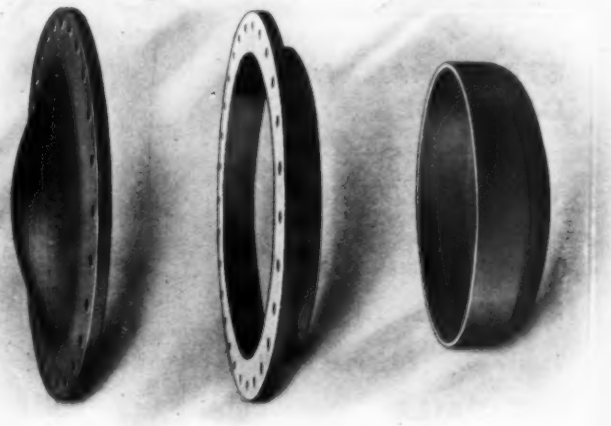

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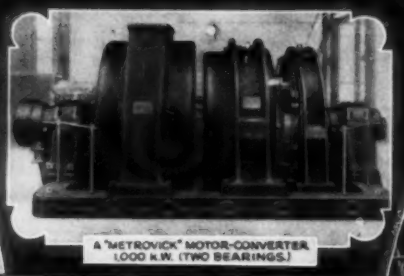

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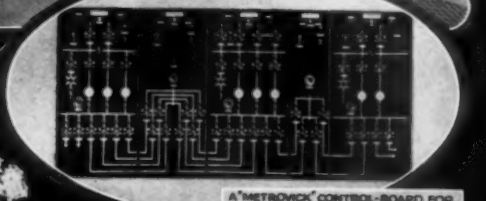

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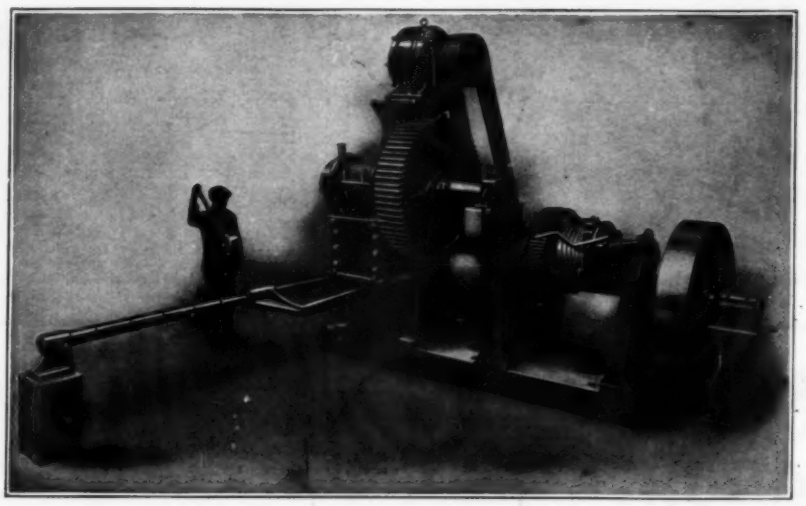

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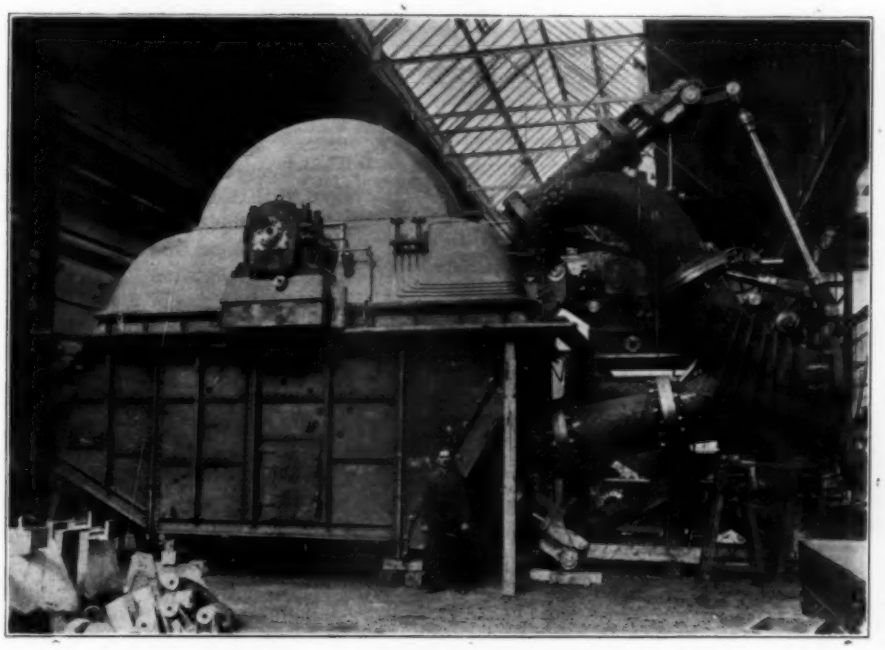

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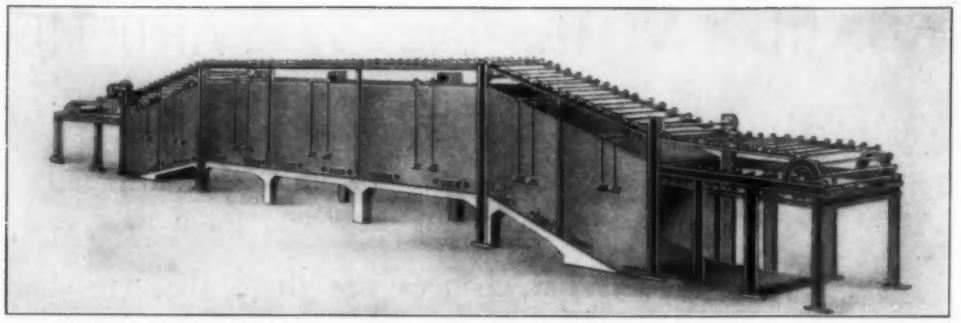

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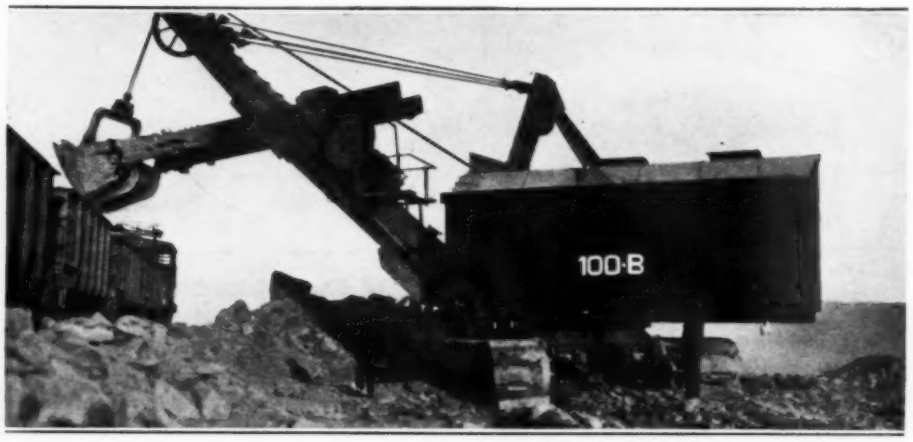

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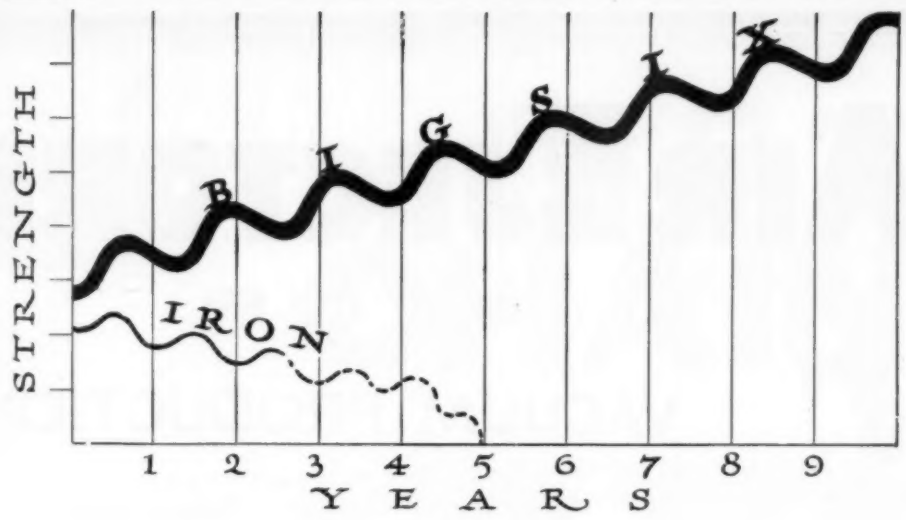

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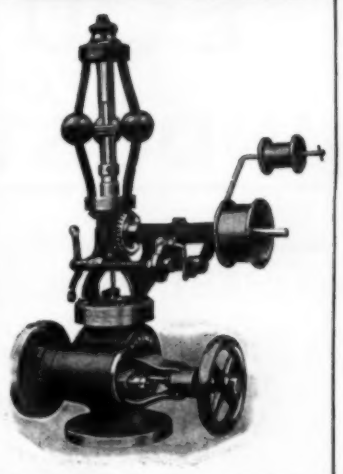

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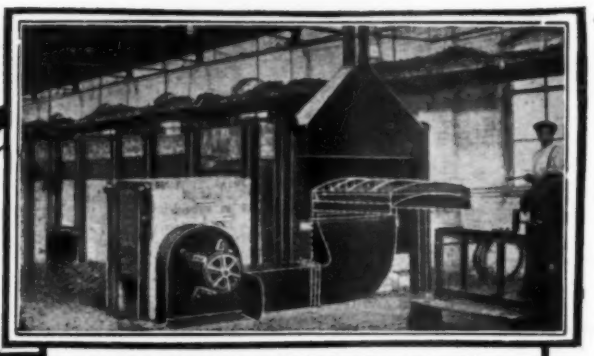

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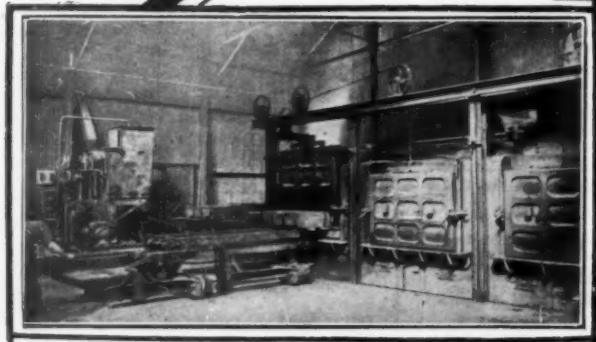

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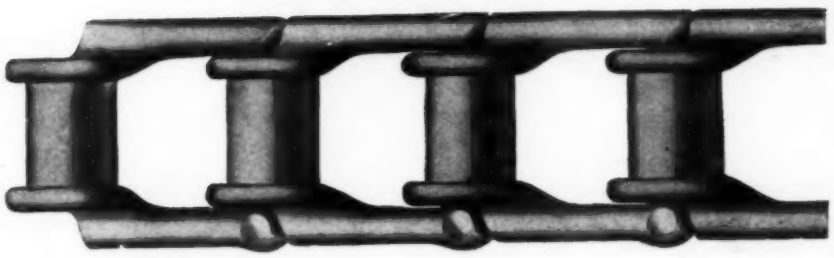

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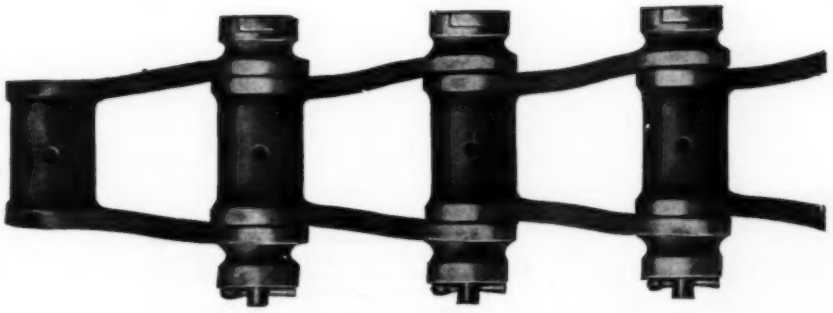

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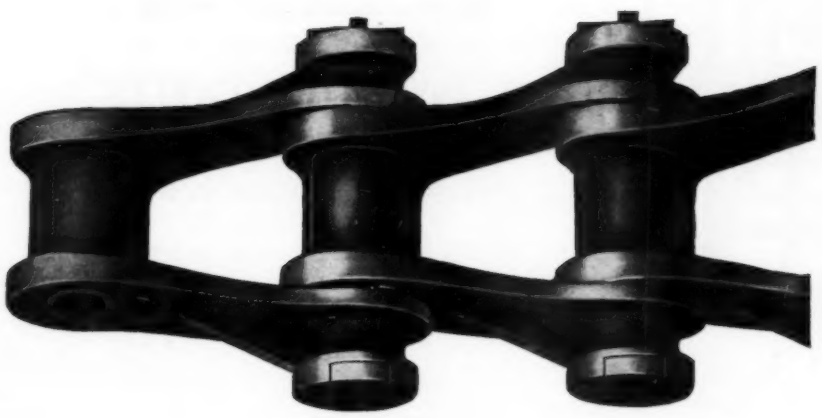

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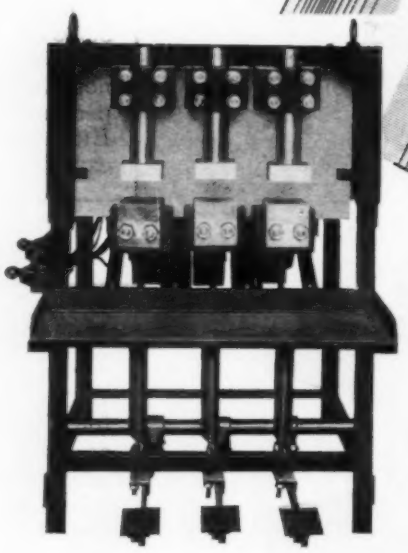

Current consumption is approximately 1 unit (k.w. hour) per 5-lbs. of rivets heated.
Speed of heating:—280 2½-ins. x ½-in. rivets per hour.
Write for full particulars of—
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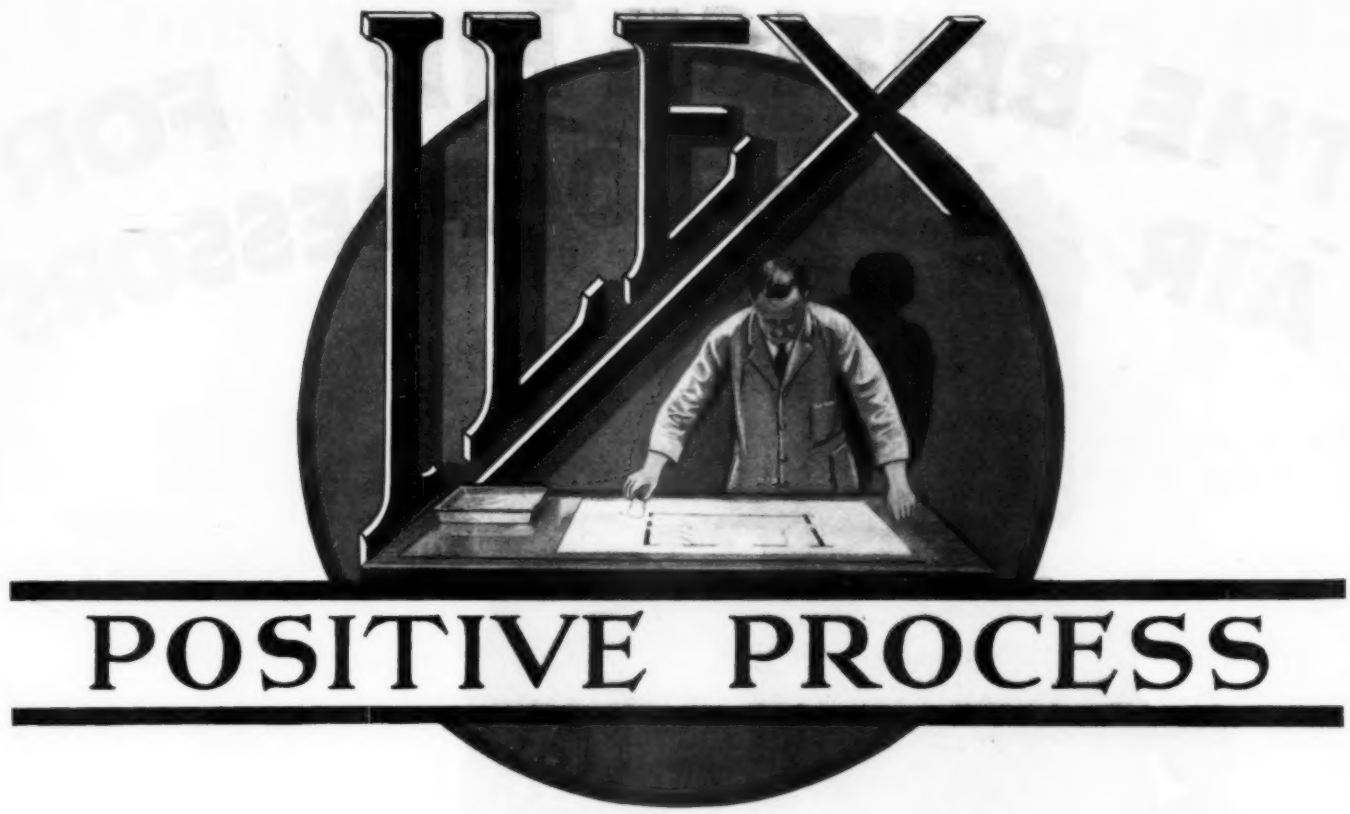

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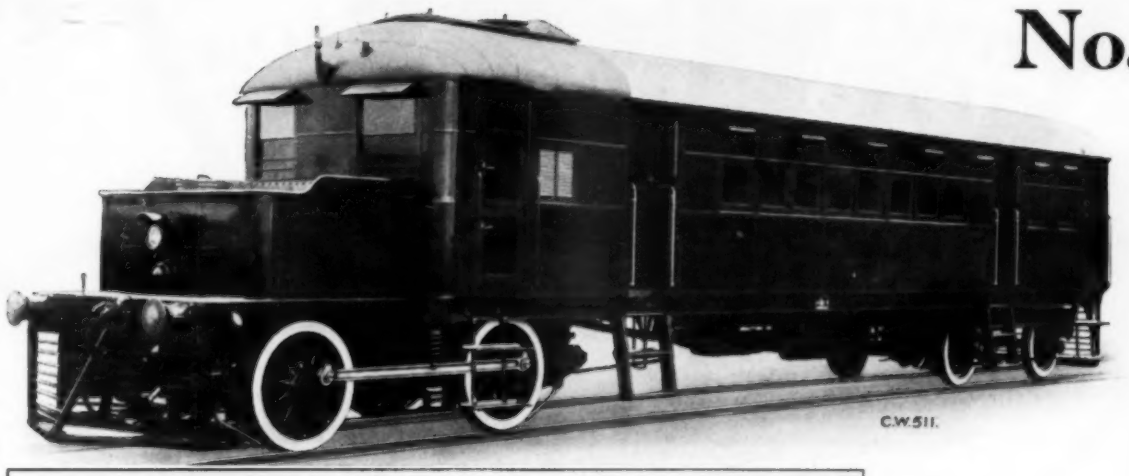
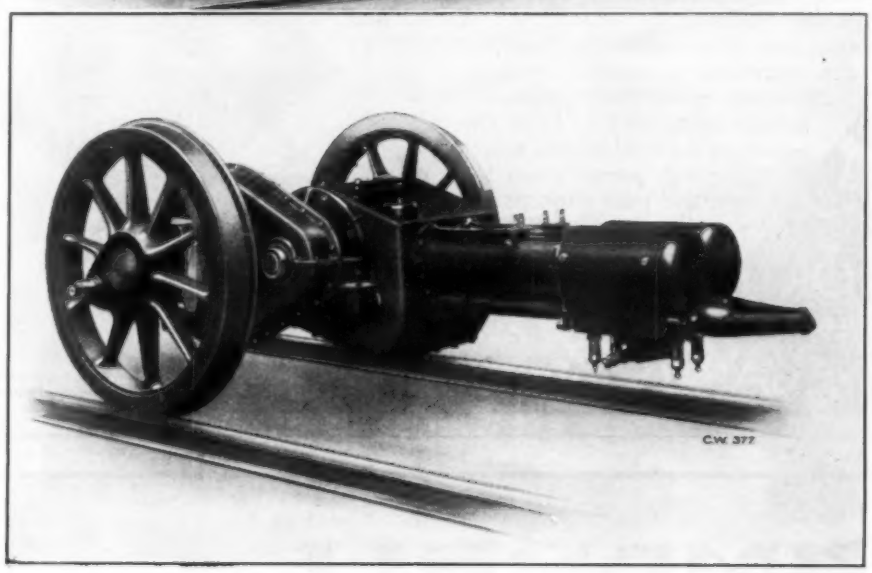
No. 3.





The ENGINE

The engine is mounted on two bearings on the axle and is additionally suspended over its centre of gravity from a universally mounted link. By this means its weight is spring-borne.

It has two simple double-acting cylinders and steam distribution is effected by piston valves beneath the cylinders. The valves are operated by variable-throw eccentrics mounted on a lay-shaft in the crankcase which is driven by spur gearing from the crankshaft.

A pinion mounted on the engine crankshaft drives a spur gear on the axle. The gears are fully enclosed and run in an oil bath.

The engine is totally enclosed and protected against the entry of dust and grit.

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Patented Design

STEAM RAIL COACHES

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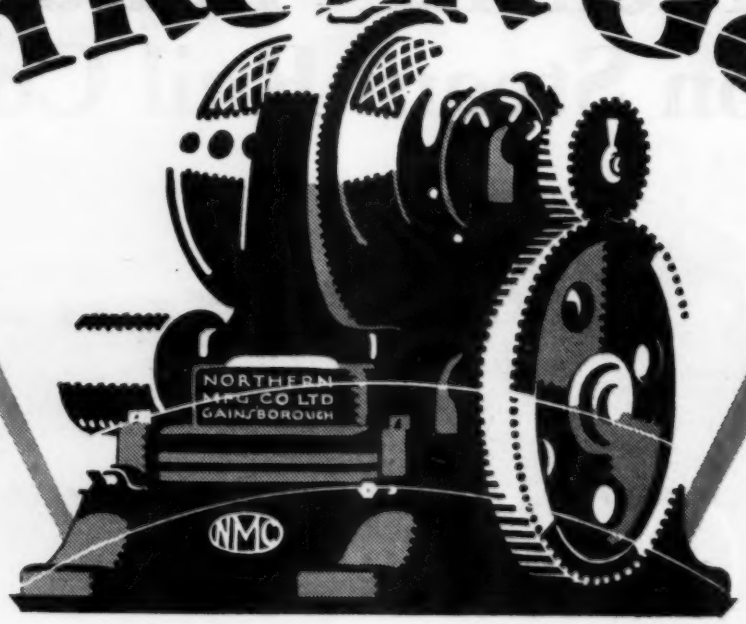

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APART FROM INNUMERABLE ADVANTAGES
WE CAN ALSO SHOW A SAVING
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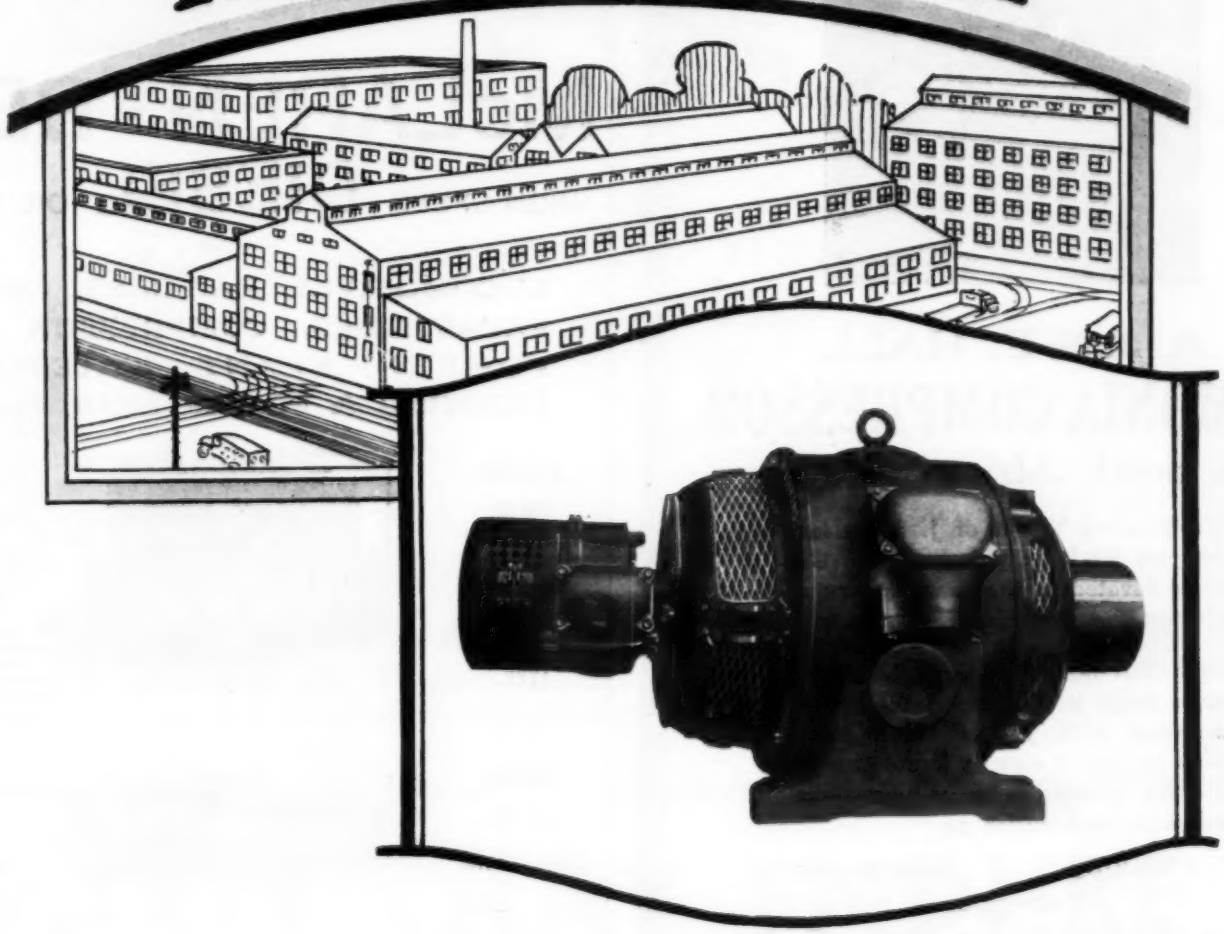
CROMPTON PARKINSON
TRU-WAT MOTOR



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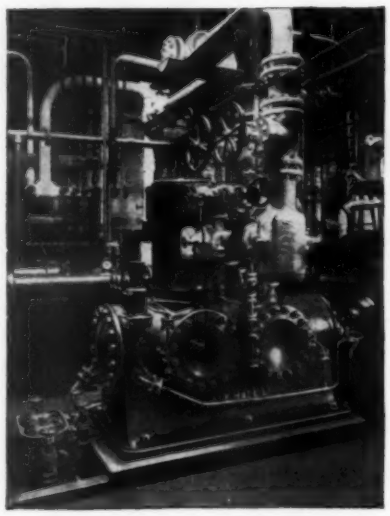

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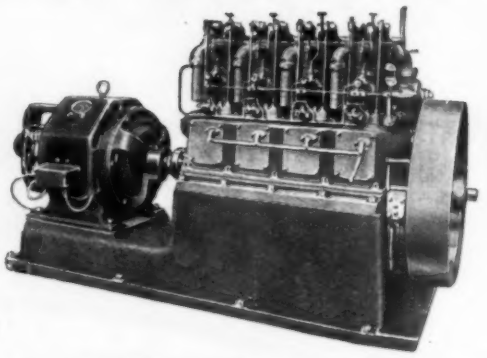

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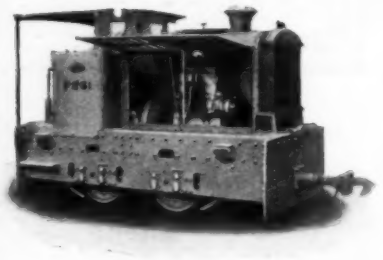

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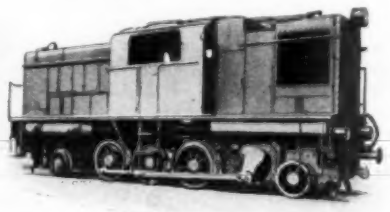

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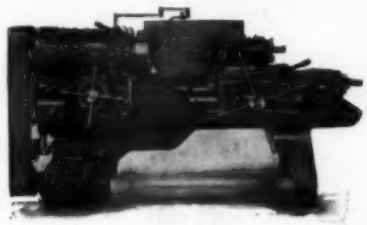

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Take away the cross-slide and you enable the turret to operate close to the headstock. This forms a combination which correctly interprets the meaning of turret lathe production. It means the proper and fullest use of the turret because the restricting influence of the cross-slide is absent. Not only are serious defects removed; they are replaced by valuable advantages. This is the principle of the

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WITH ITS

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It may be summarised as the debit and credit of *your* production.

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Restricted facing.
Special tool holders and tools not conducive to easy setting.
"Two member" tool carrying prevents rapid operation. The cross slide must be moved to make way for the turret and *vice versa*.

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Short Stiff tools.
Direct cutting without pilots and steadies.
Unrestricted multiple facing.
Simple standard tools easily set.
Unified tool carrying greatly simplifies operation. The one tool carrier—the flat turret—operates all tools.

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Engineers often find when dismantling plant or machines that the only items which do not need replacement are the parts which some clear-headed individual specified to be made from Firth Stainless Steel. For the rest Rust has taken its toll—thinning and weakening the castings — throwing dimensioned parts out of truth—pitting the valve seats—welding—as only rust can weld—the bolt threads to the nuts. Whenever there are corrosion zones—zones where vital parts come into contact with moisture, chemicals or hot gases—whenever part of your reputation goes out with the machines or plant you build, make sure that in every corrosion zone there are parts made from one or other of the Firth Stainless or Heat Resisting Steels.

An impeller casting, a valve, and a gland made of Firth Stainless Steel.

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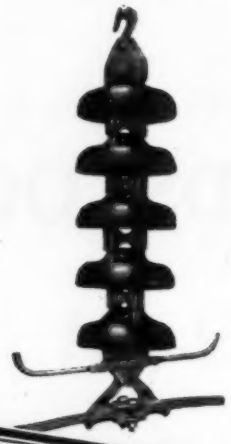
Bullers
Insulators
and
Equipment for
all voltages



These illustrations are taken from actual photographs of Bullers Overhead Line Equipment in service in all parts of the world.

Bullers manufacture Insulators and accessories for all voltages to give satisfactory service under any climatic conditions.

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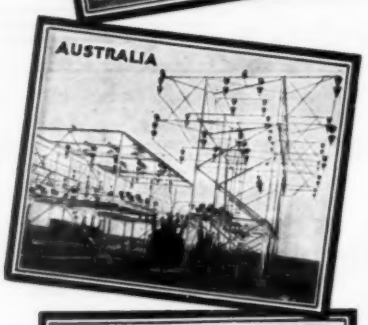
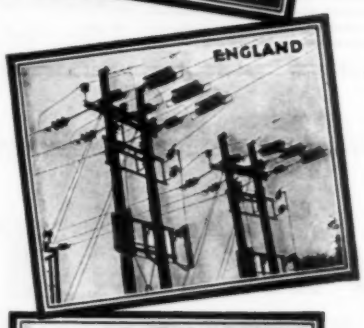
NEW ZEALAND. 11 k.v. *Horowhenua Scheme.*





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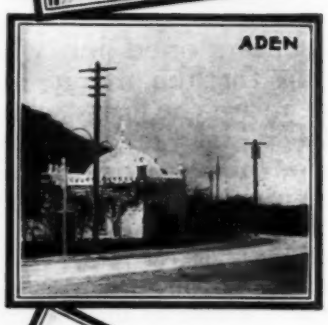

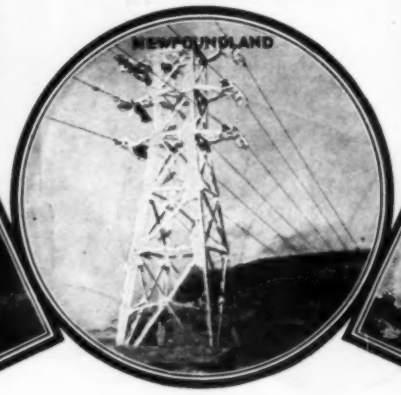

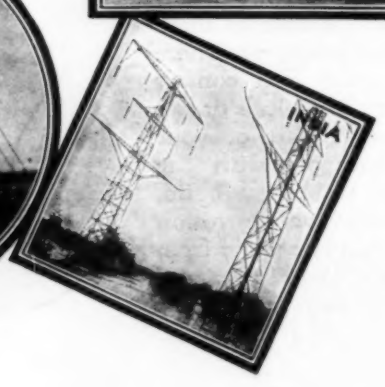

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The Tractor is built in our own works, where demonstrations can be arranged at any time by appointment.

The most economical method of haulage.

EXCEPTIONALLY LOW FIRST COST in comparison with all other power units—either steam or petrol.

LOW RUNNING COSTS. Using paraffin the consumption on a day's work—8 hours—from 6 to 8 gallons according to loads and track conditions.

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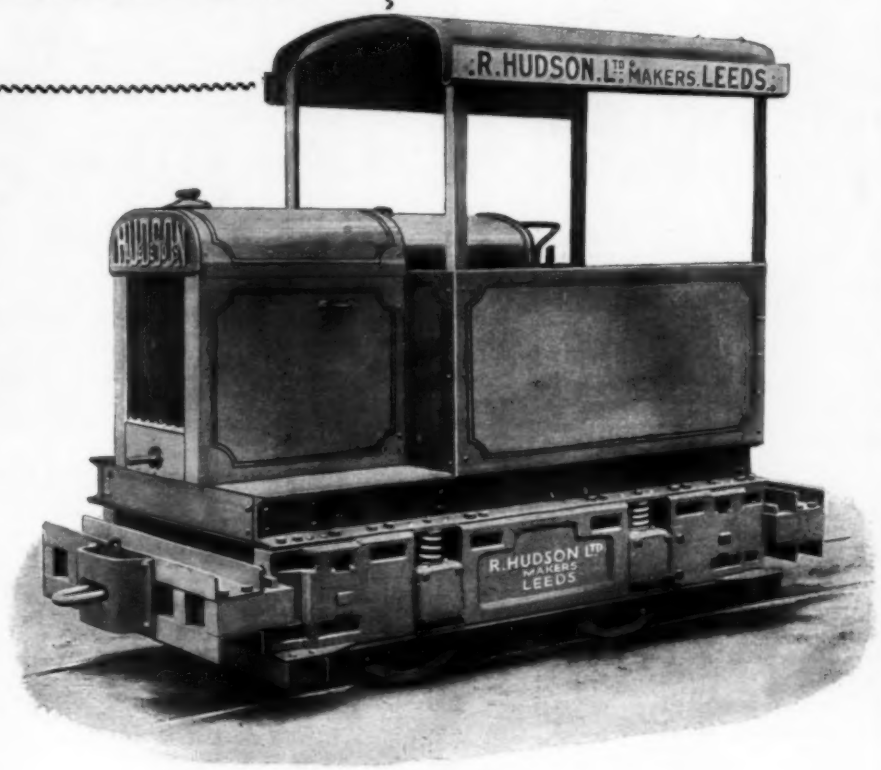
FOR NARROW OR STANDARD GAUGE. The Hudson Tractor is suitable for haulage on Light Railways, or for shunting purposes on railways of standard gauge.



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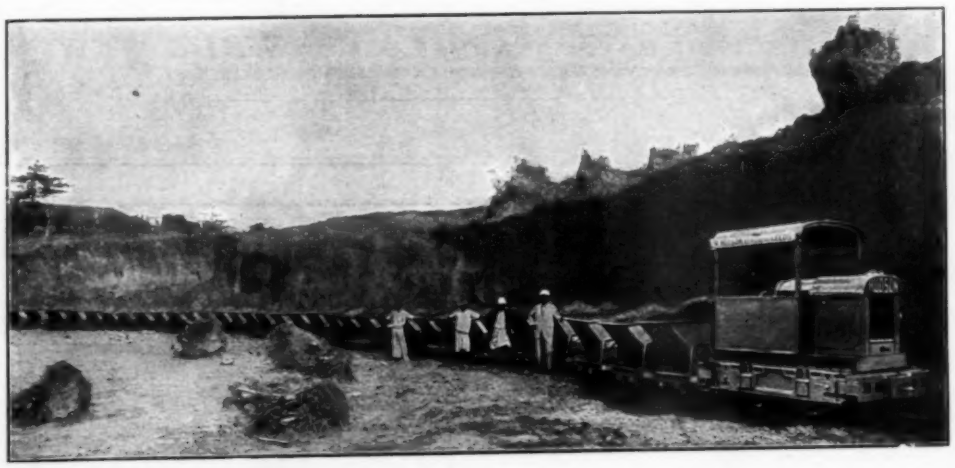

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THE LARGEST BRITISH MANUFACTURERS of COMPLETE EQUIPMENT for LIGHT RAILWAYS

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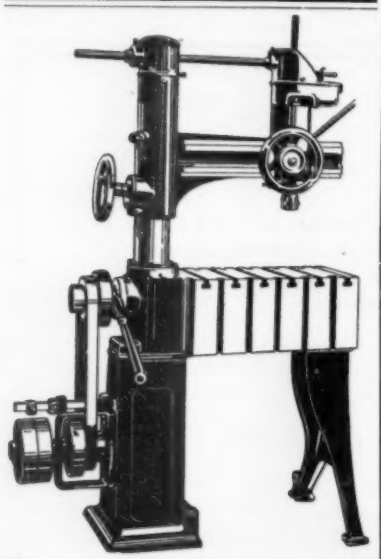

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Sensitive-Radial

An inexpensive drill designed for general factory and maintenance work. A tool that combines the advantages of sensitive, vertical and radial drills in one all-round handy machine.

Costs only **£48**

High speeds for light w rk. Powerful drive through back gears for heavy drilling.

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Where else can you find anything like the capacity for handling a variety of work in such an inexpensive tool?

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MOVING FIRE-BARS

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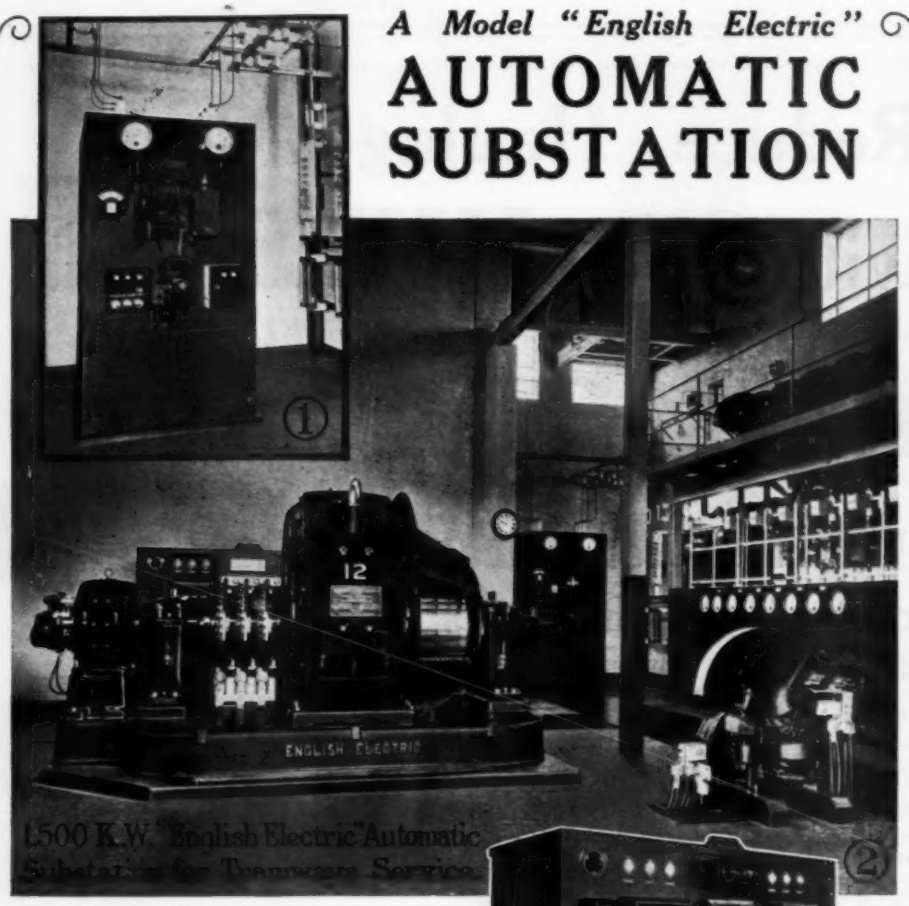
A Model "English Electric"
AUTOMATIC SUBSTATION



AUTOMATIC Substation Equipments have been supplied or are in hand for Gt. Britain, Ireland, Australia, New Zealand, India, Japan and several European countries. The equipment illustrated is in service at Adelaide.

The Rotary Converter has a normal output of 1,500 k.w. Illustrations: (1) shows the sheet steel cubicle containing the main oil circuit-breaker, which controls the 10,000 Volt 3 phase supply; (2) shows the general arrangement of the station with the high-speed circuit-breaker in the foreground; (3) shows the relay panel and D.C. controlling apparatus, embodying the Company's camshaft controller.

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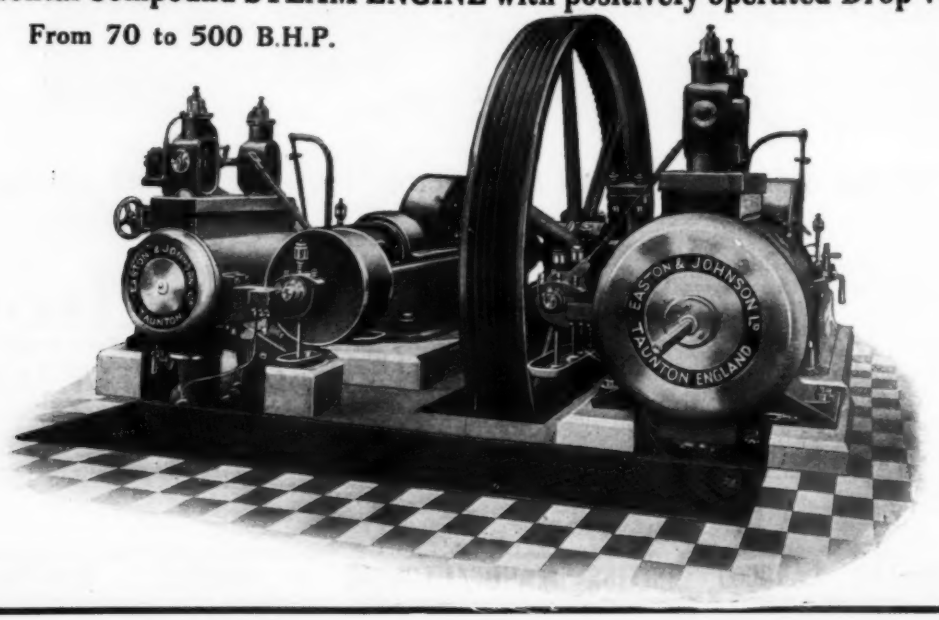
Horizontal Compound STEAM ENGINE with positively operated Drop Valves

From 70 to 500 B.H.P.



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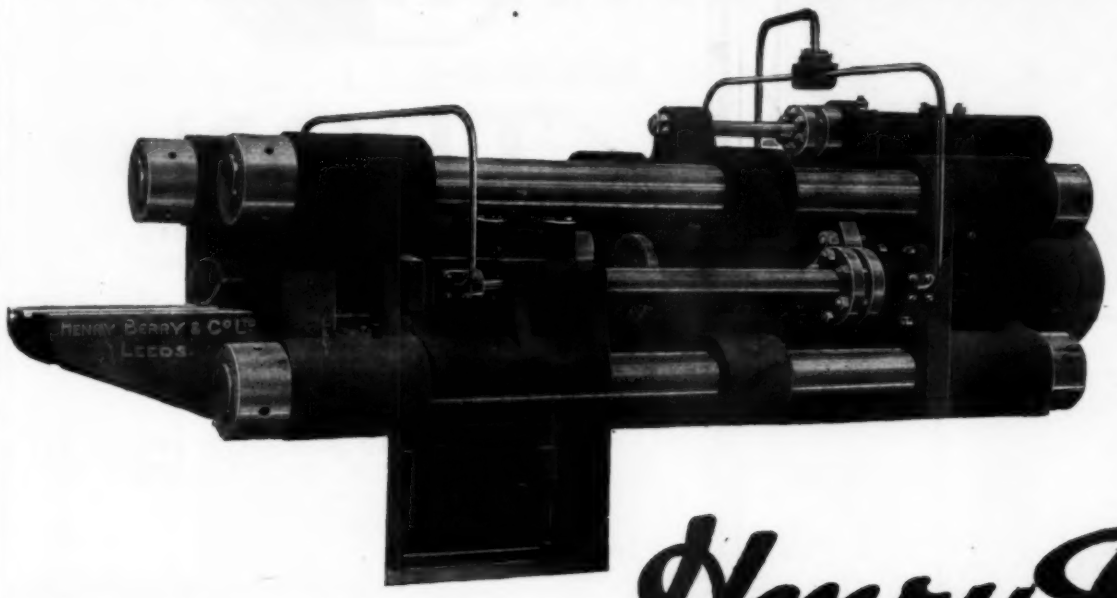
WE ILLUSTRATE BELOW OUR 1000 TONS Ordinary Hydraulic Extruding Press designed for extruding metal into bars of all sections.



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IMPROVED SPOKE BENDING MACHINES.
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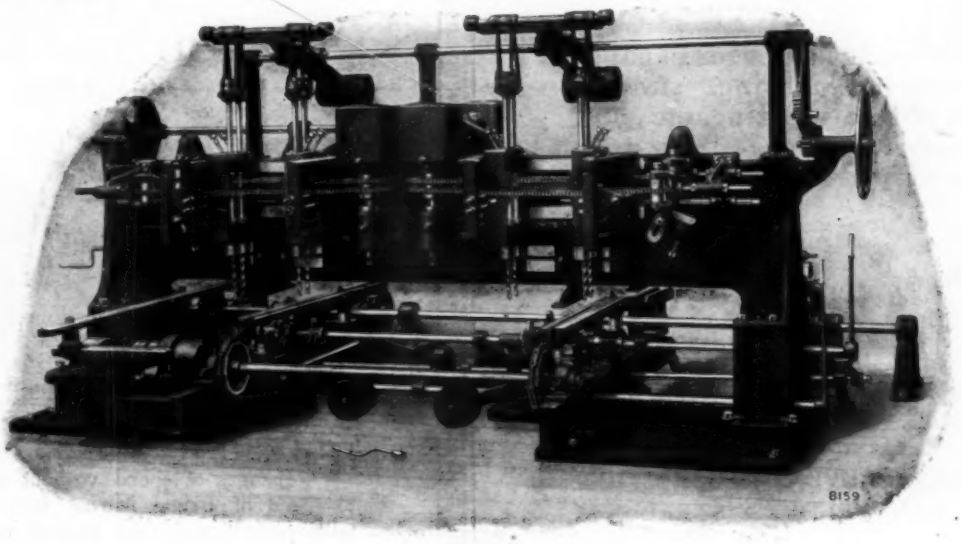
Henry Berry & CO LIMITED. LEEDS.

Semi-Automatic Sleeper Adzing & Boring Machine

with Flexible Bed. **Type MJ**



This is a semi-automatic machine for Adzing and Boring the rail and chair seatings of sleepers at one handling. It gives a large output in either soft or hard woods such as Quebracho. The flexible bed allows for considerable variation and irregularity in the thickness of sleepers, while maintaining the seatings in correct relative alignment. It can be supplied to bore 2, 3, or 4 holes in each rail seating, either vertically or at an inclination of 1 in 20.

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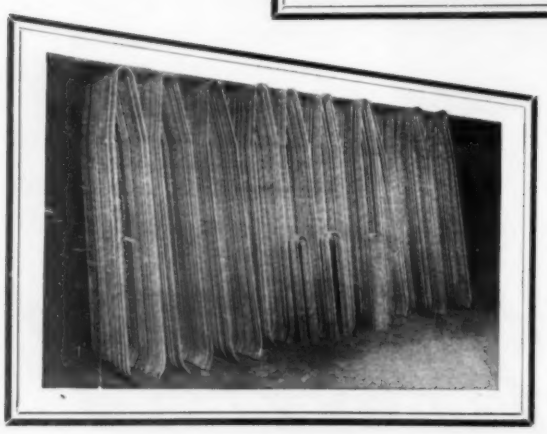
Manipulated Tubes in Weldless Steel



In addition to the manufacture of plain Weldless Steel Tubes in all sizes from ¼″ to 15″ bore, we undertake the manipulation of tubing to any special requirement.

Our works have facilities for expanding, reducing, thickening, staving, electro and hot galvanizing, etc., and we can supply tubes made from acid, corrosion and heat-resisting steels.

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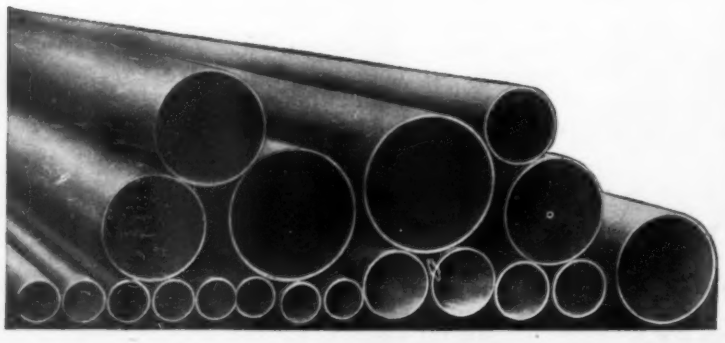
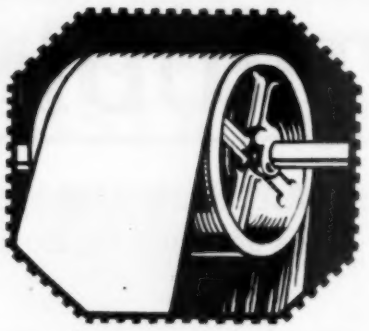
TUBES OF EVERY DESCRIPTION
IN WELDLESS STEEL.





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is the strongest guaranteed belt, which satisfies any power transmission problem. It is stretchless with a lasting equality of driving grip. Pliable and straight running.

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LIGHT AND HEAVY STEEL PILING
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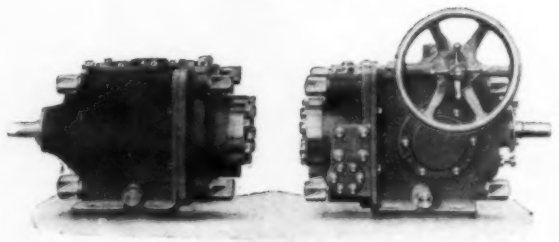
"VSG"

HYDRAULIC VARIABLE SPEED GEARS.



Type "K" "VSG Mark III" Variable Speed Gear, fitted with handwheel control.

THESE Hydraulic Gears provide infinite changes of speed without steps from Zero to speed of Prime Mover, forward and reverse, with perfect and easy control and high starting torque.

Suitable for Ships and Shipyard Machinery, and Industrial Machinery such as:—Linoleum, Paper-Making, Printing, Rubber, Textile, etc.

Thousands already in use.

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VICKERS-ARMSTRONGS STEELS

THE

CRANKSHAFT

produced as a Drop Forging
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was of

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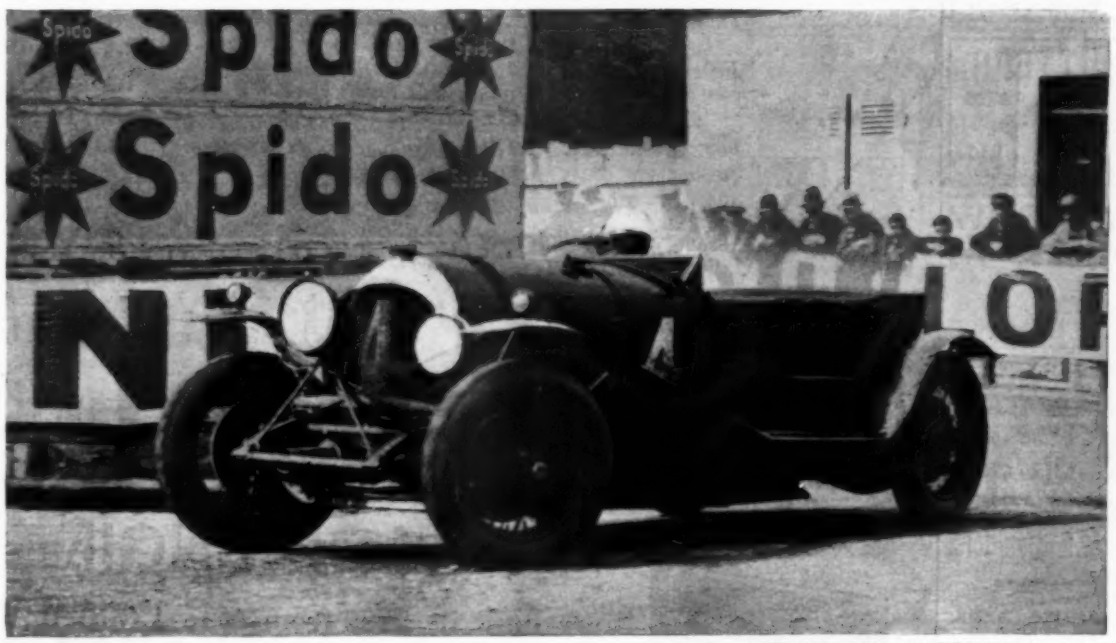
Total distance covered by the BENTLEY CAR 1,668 miles, average speed 69½ m.p.h.



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The victorious Schneider Trophy Supermarine-Napier S. 5 which attained a speed of 284.14 m.p.h. (Napier "Lion" Engine).

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Captain Malcolm Campbell's "Blue Bird" Car at Pendine (Speed 174.883 m.p.h.).

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Heat-Treated Steel Bolts are "Twice as Strong" as Ordinary Bright Bolts

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SEND FOR PROOF THAT THIS IS THE SMOKE-CURE FURNACE AND GIVES FUEL ECONOMY.
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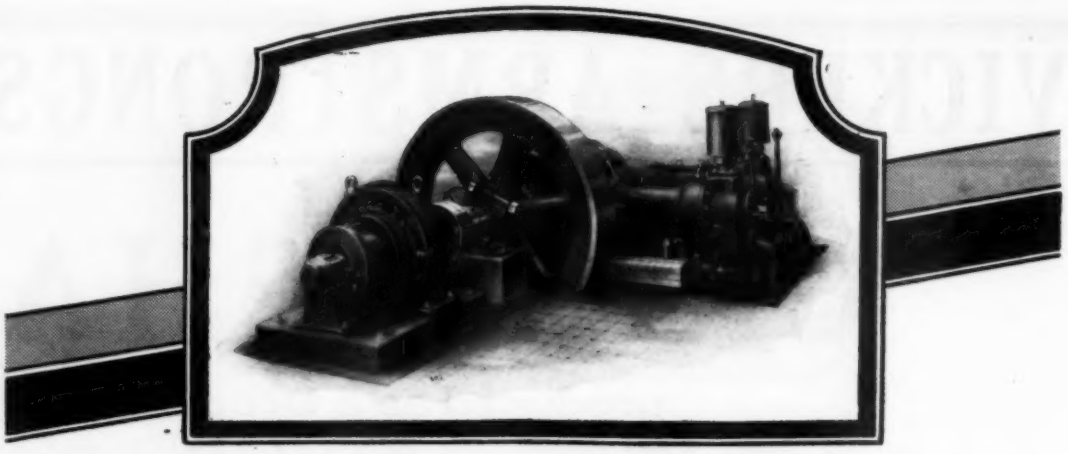

The Illustration is of a 200 B.H.P. Direct Coupled Alternator Type Engine.

SAVED £207 IN FUEL COST IN TWELVE MONTHS.

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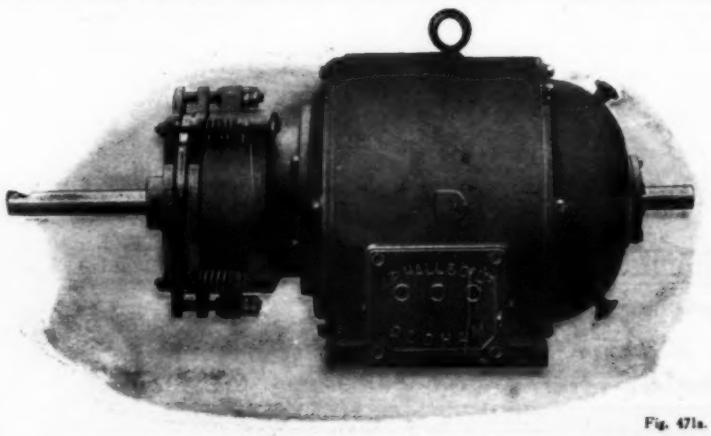

Fig. 471a.

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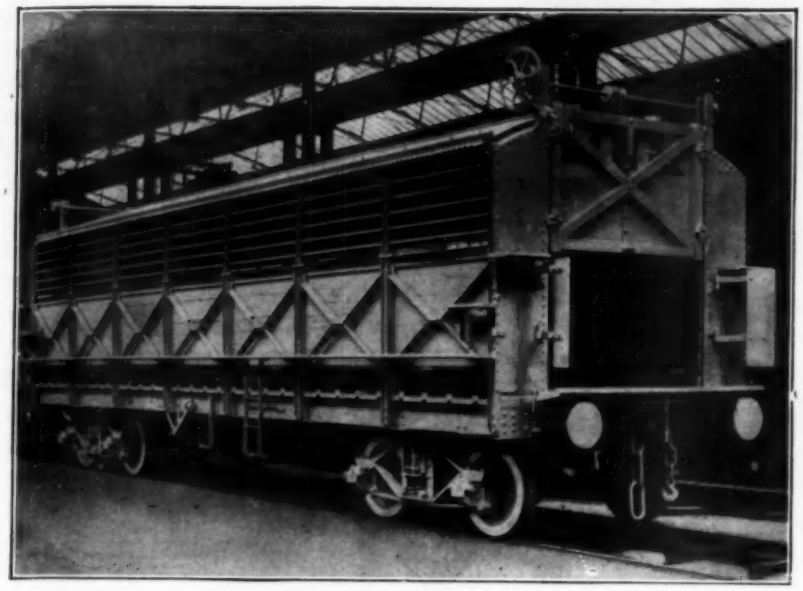

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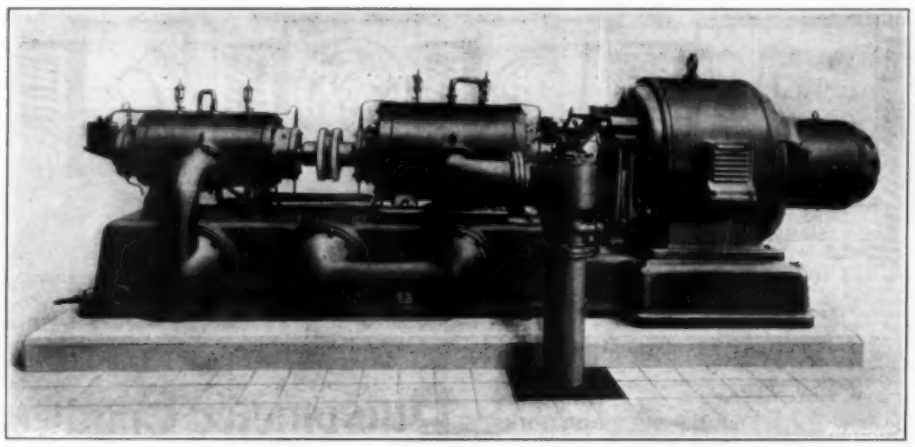

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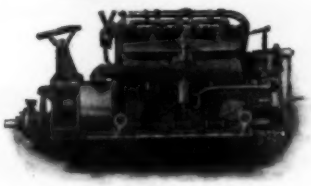

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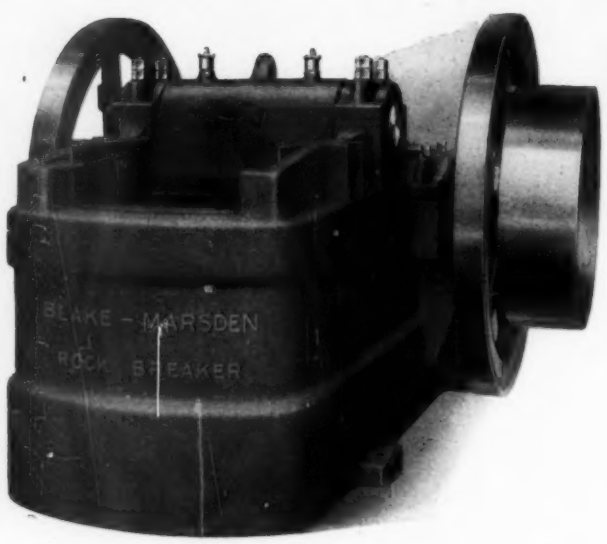

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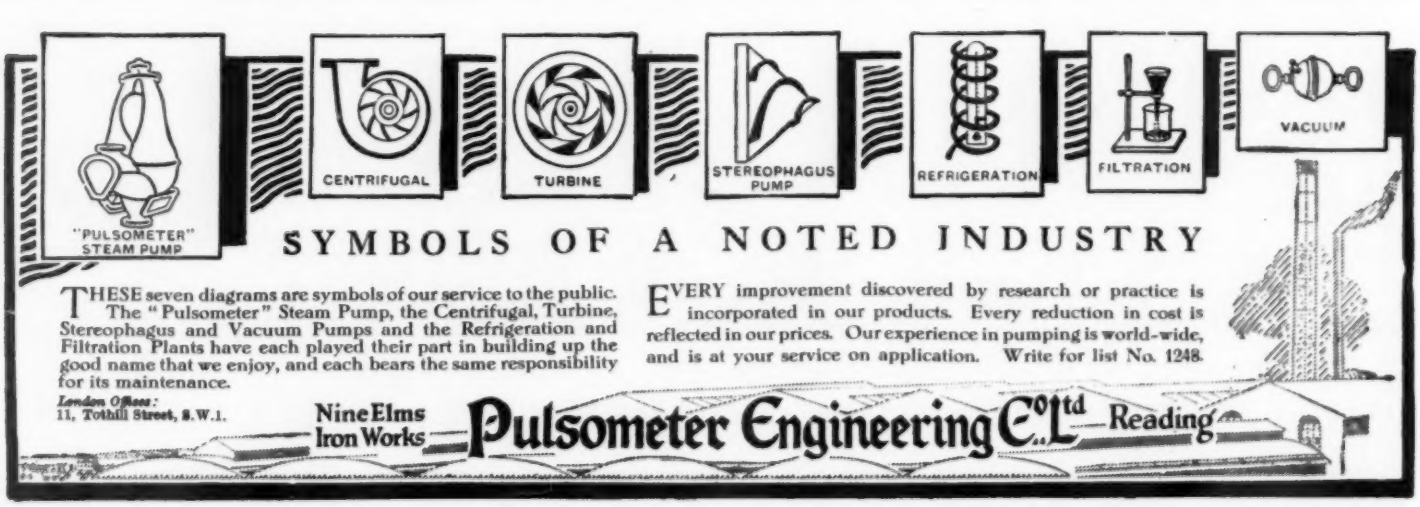

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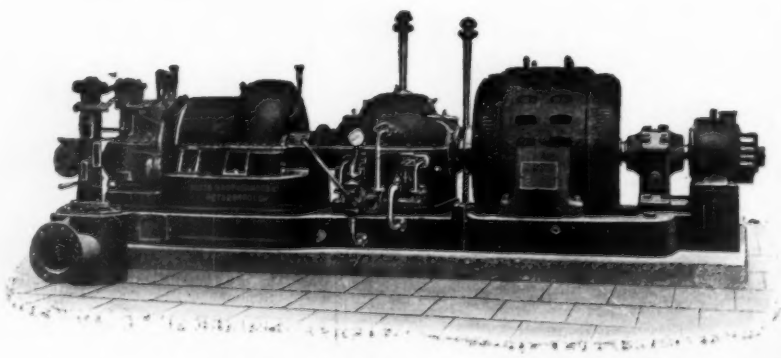

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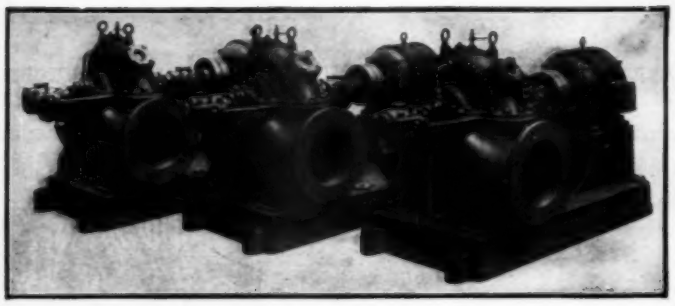

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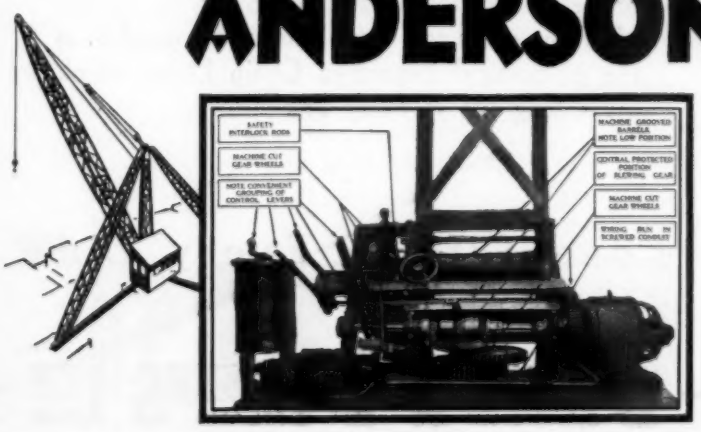
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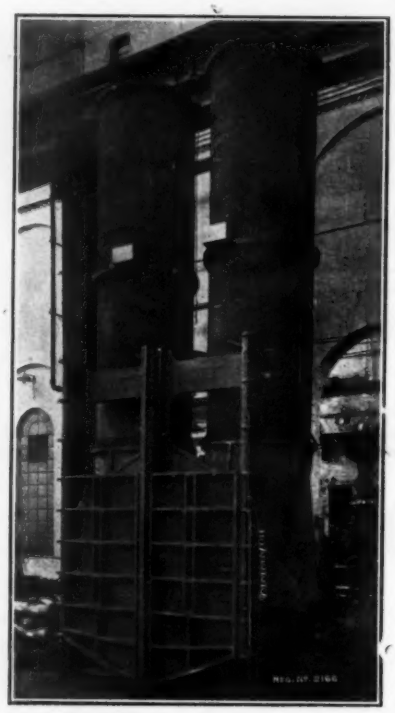

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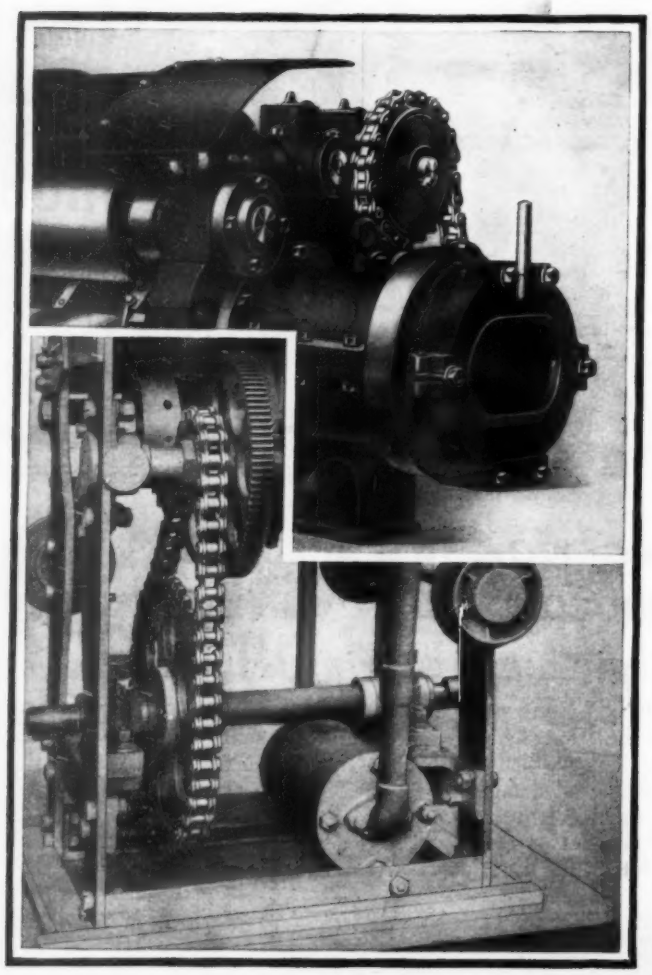

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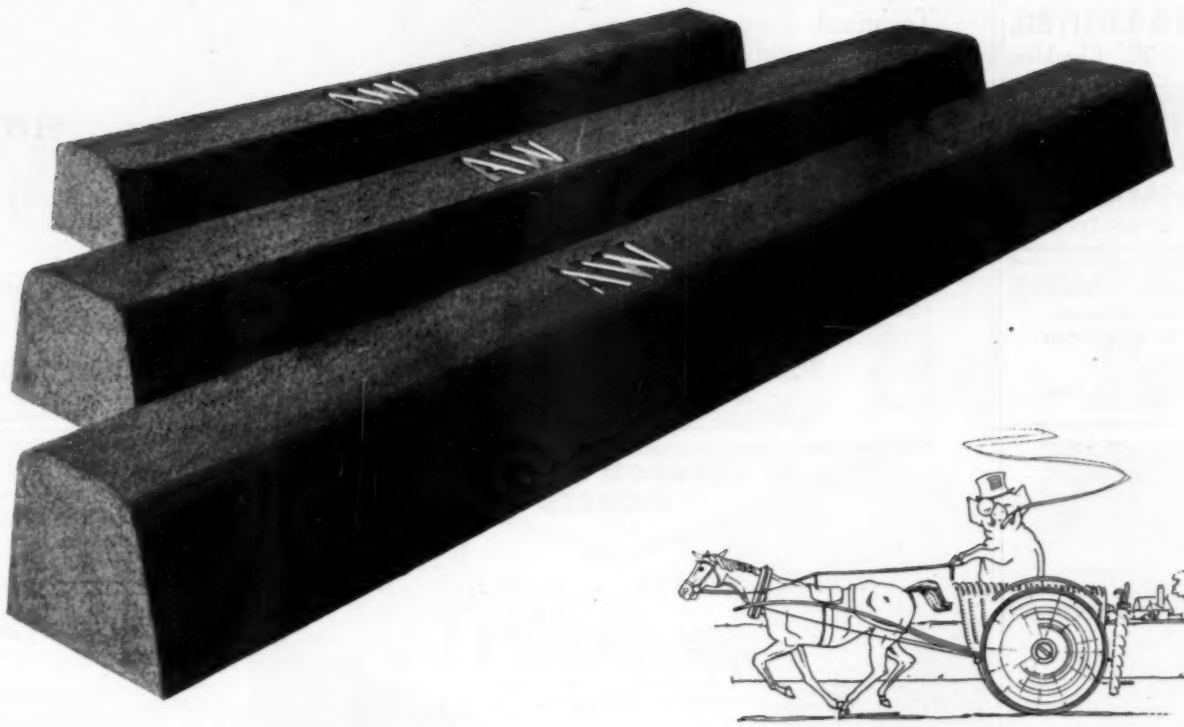

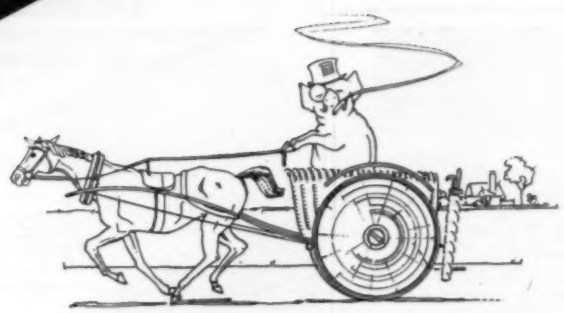

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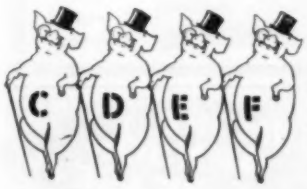

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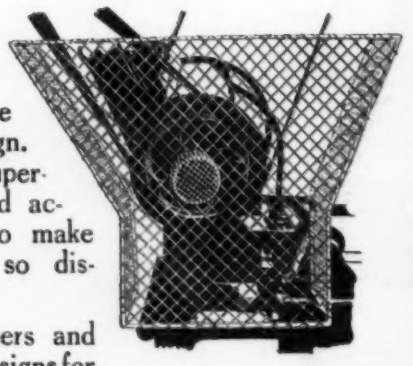

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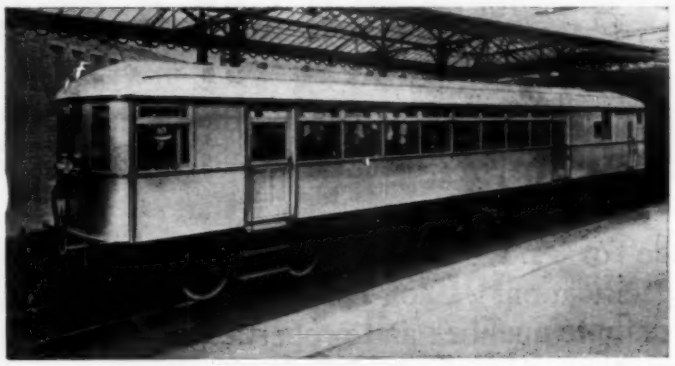

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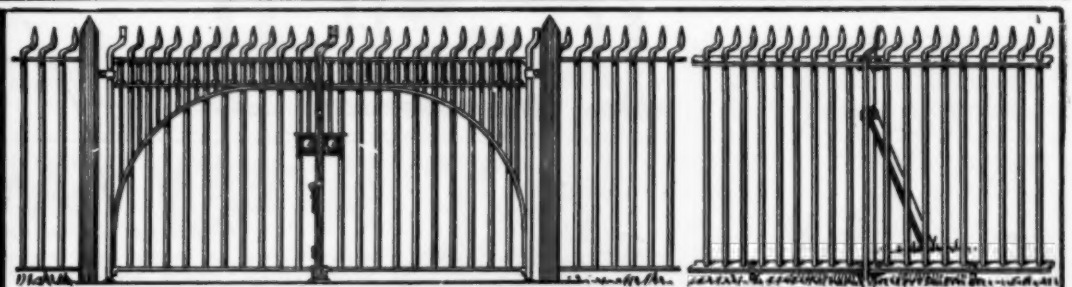

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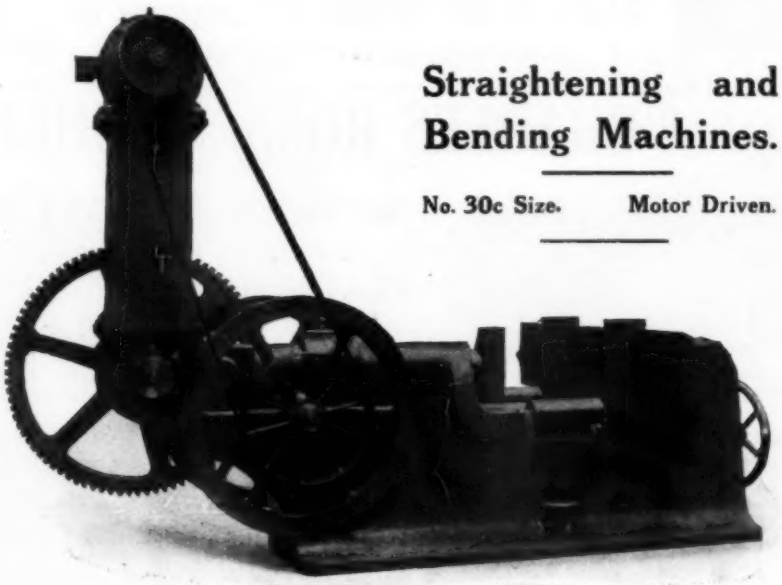

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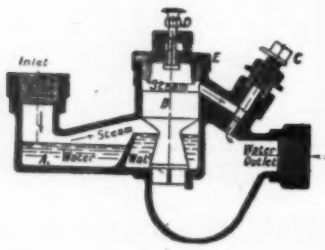

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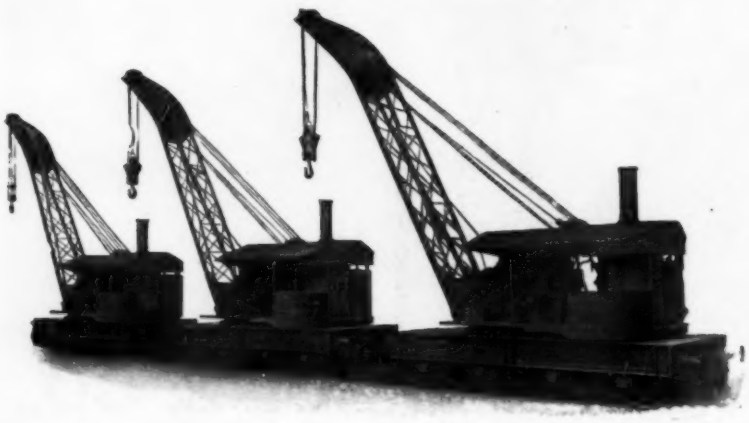

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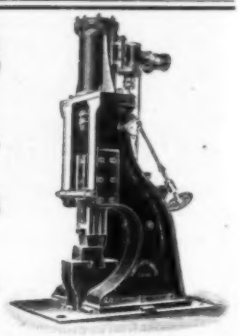

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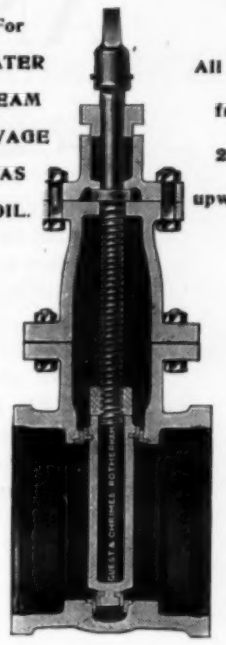

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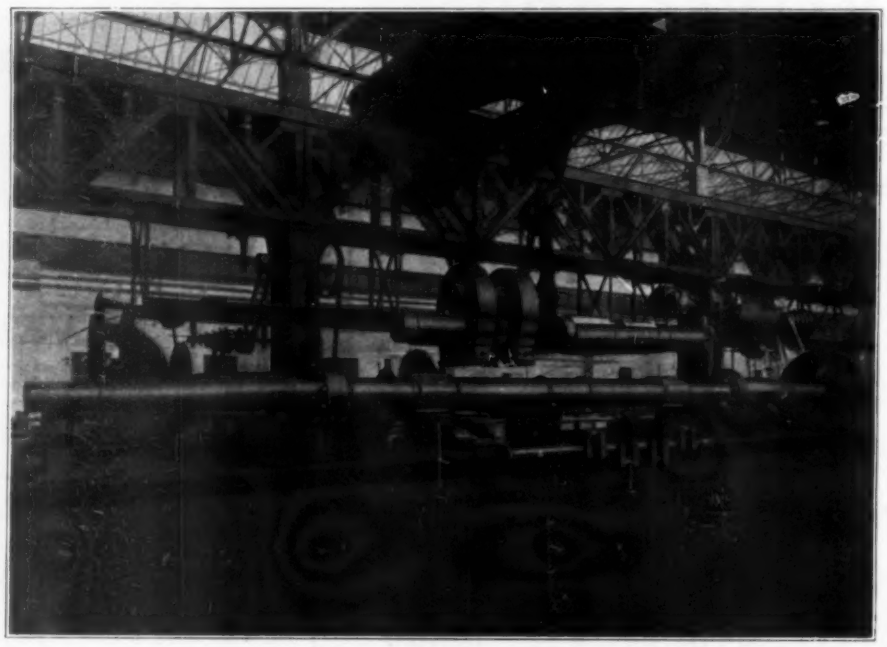

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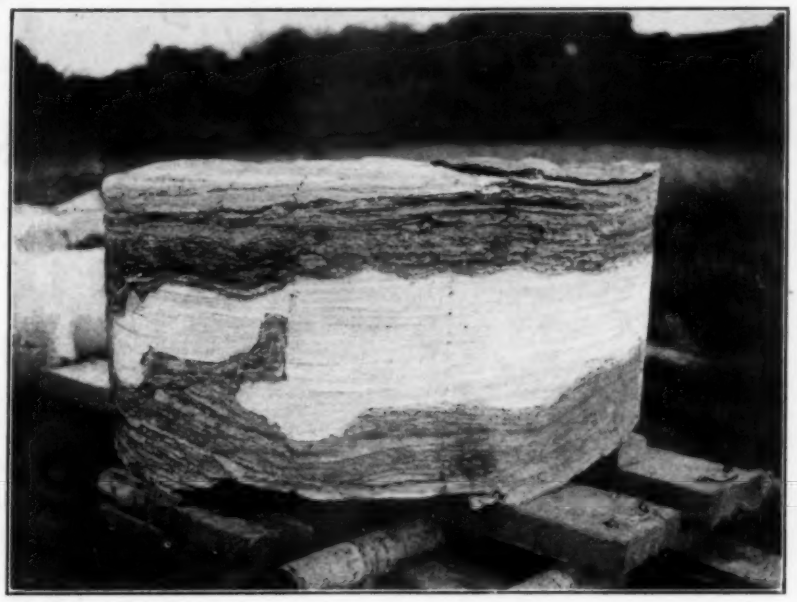

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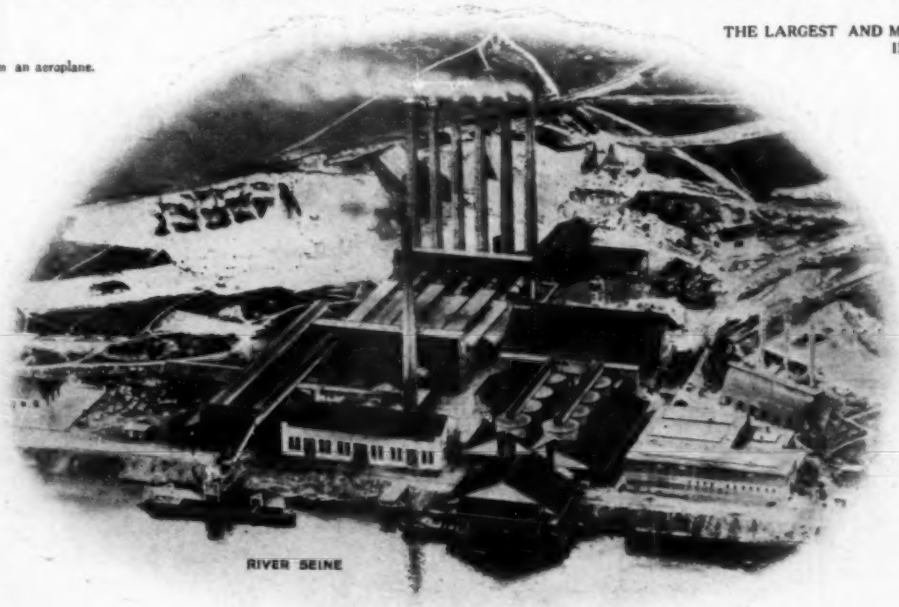

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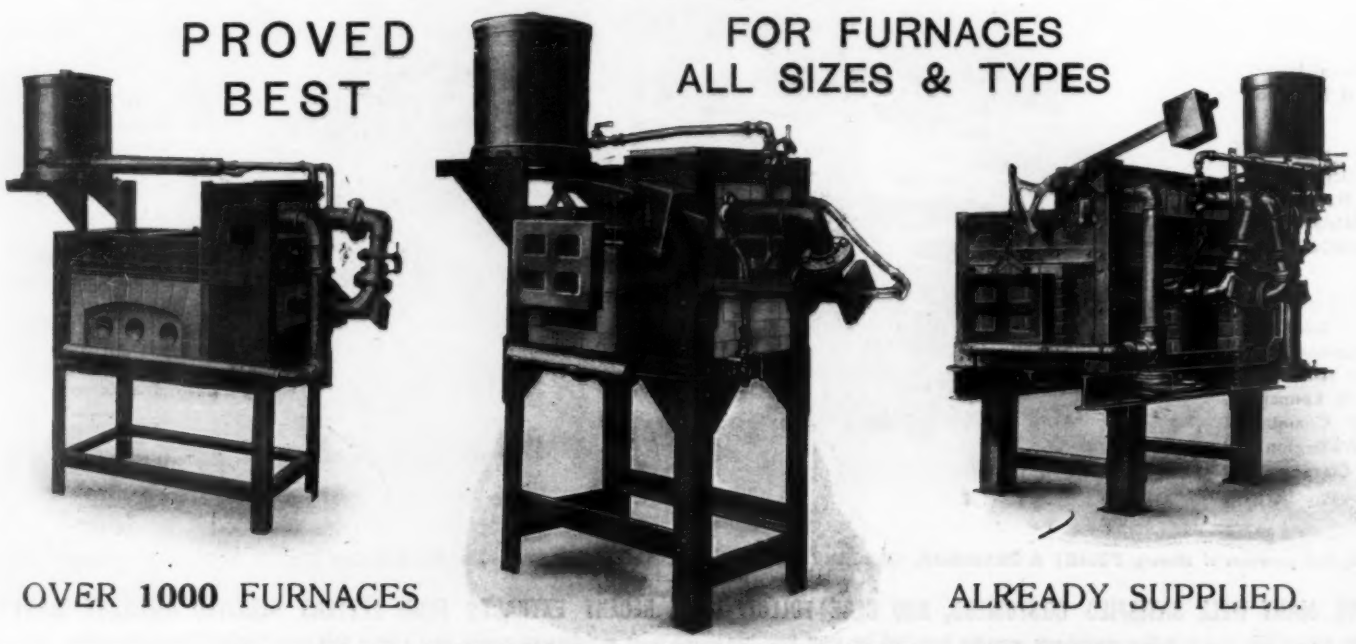

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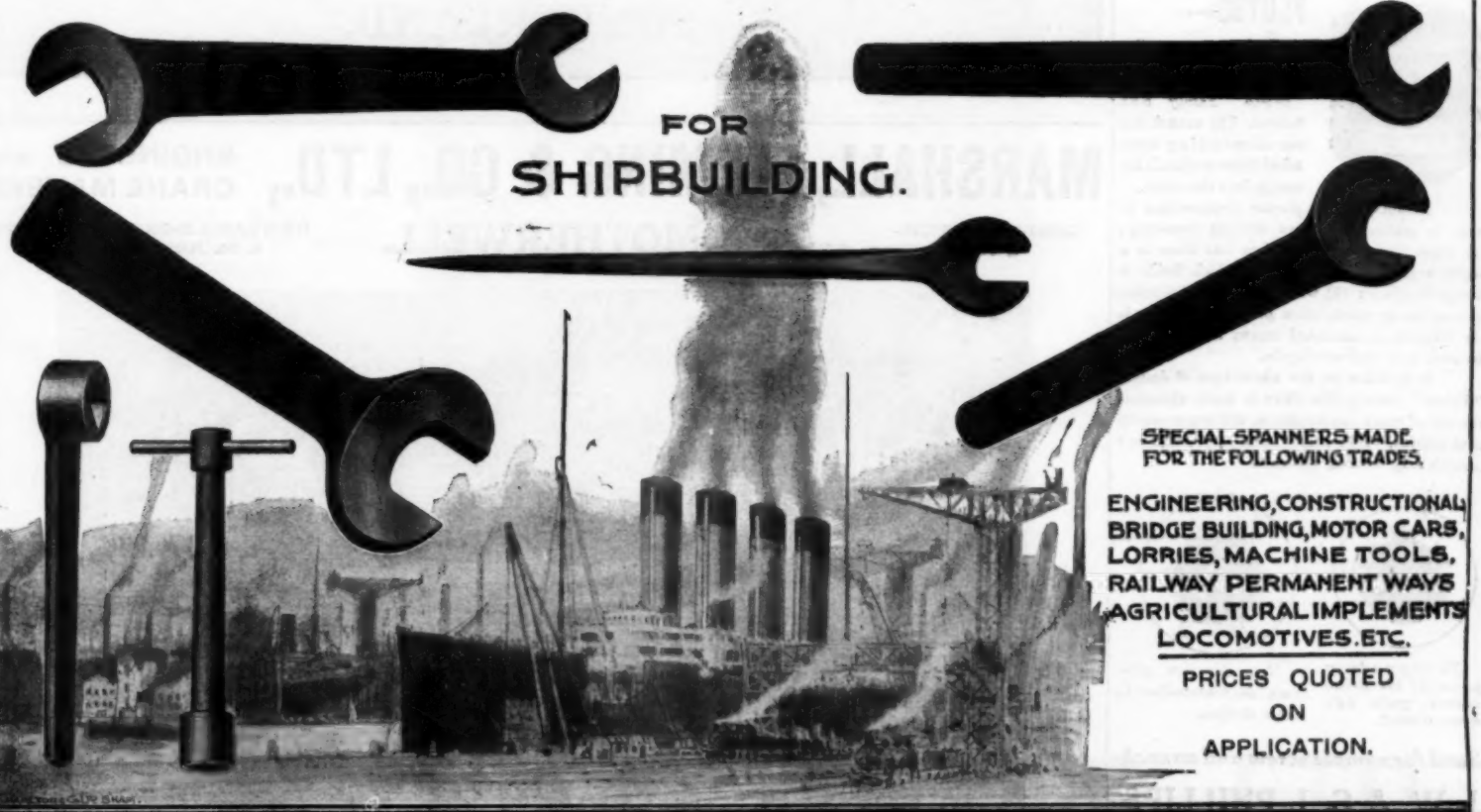

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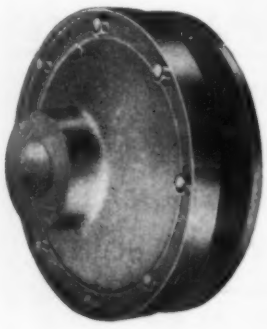

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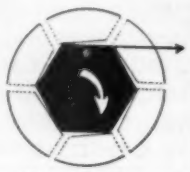

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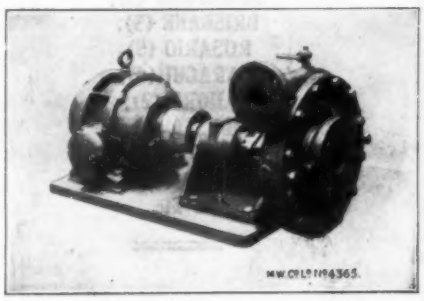

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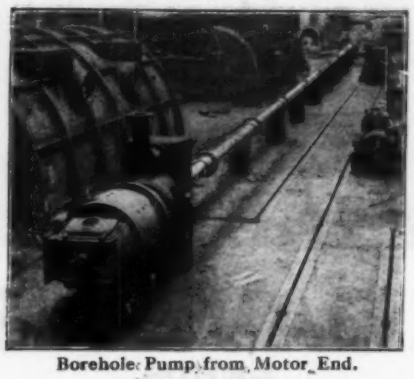
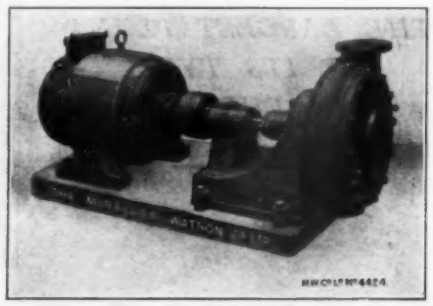


Borehole Pump from Motor End.



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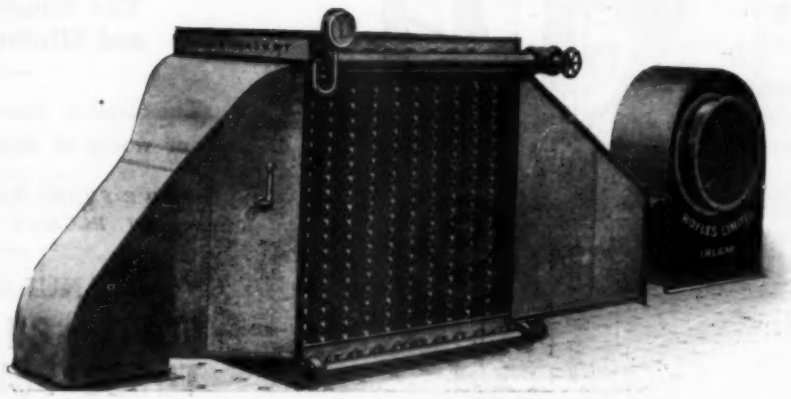

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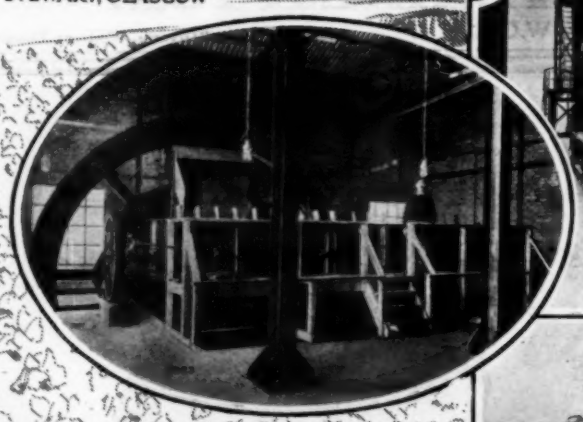

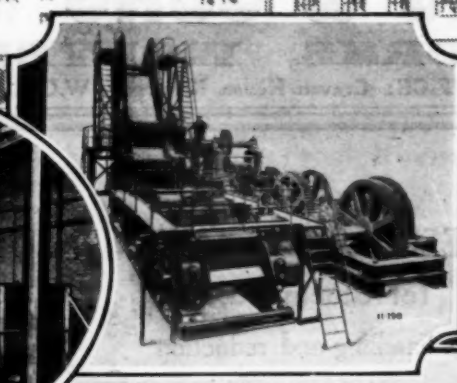

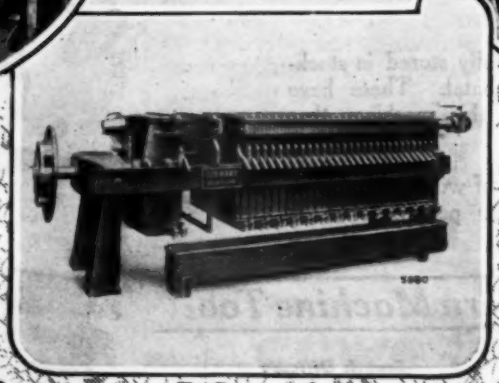

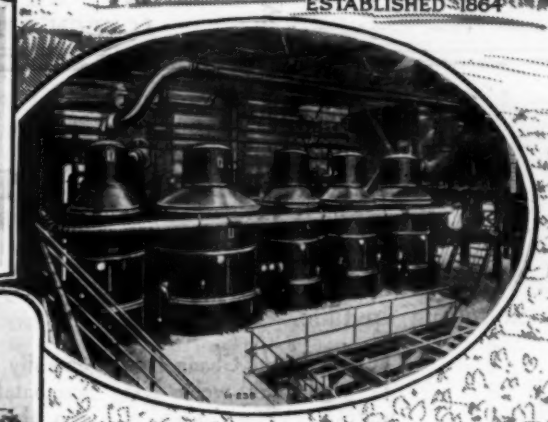

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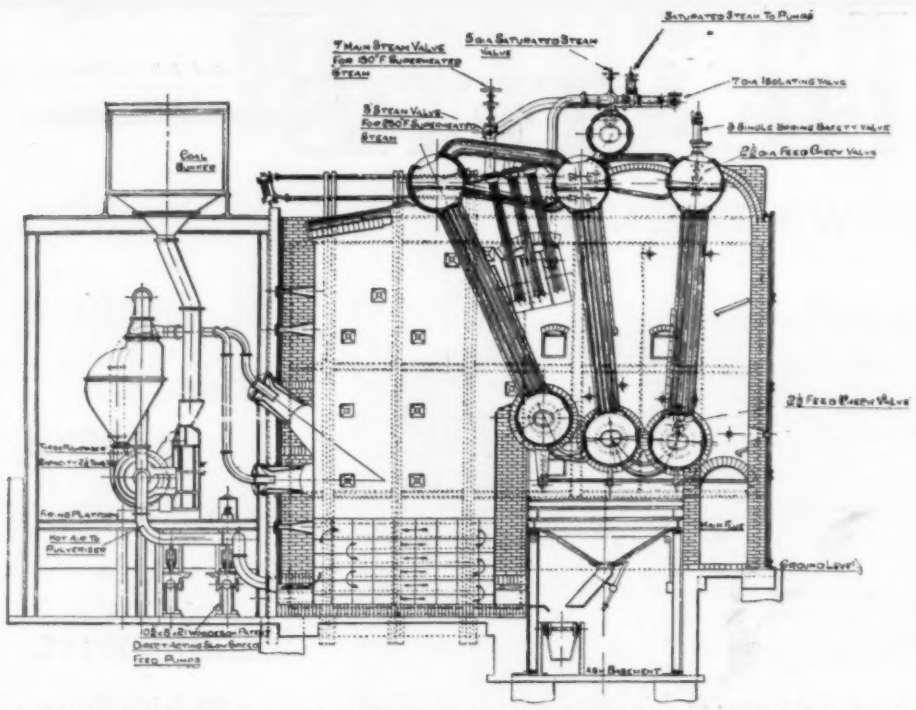

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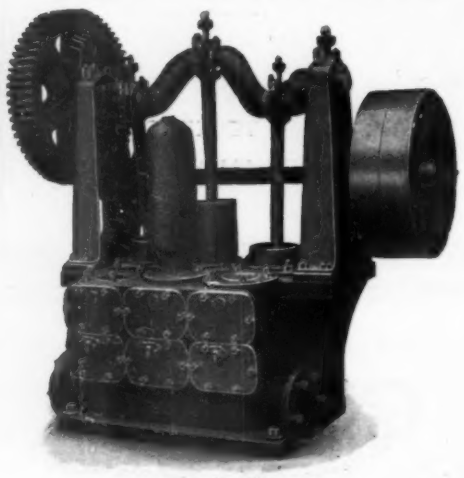

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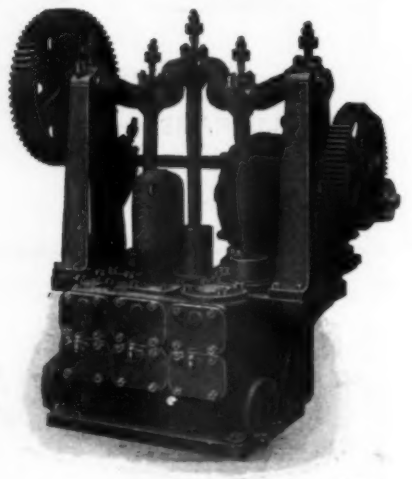

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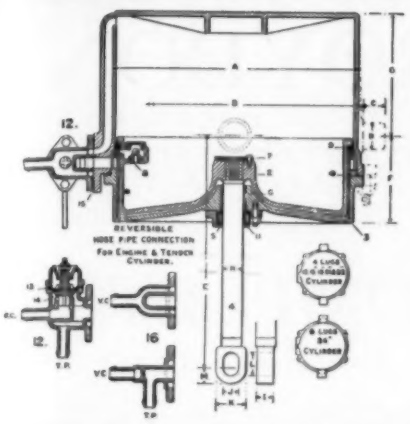

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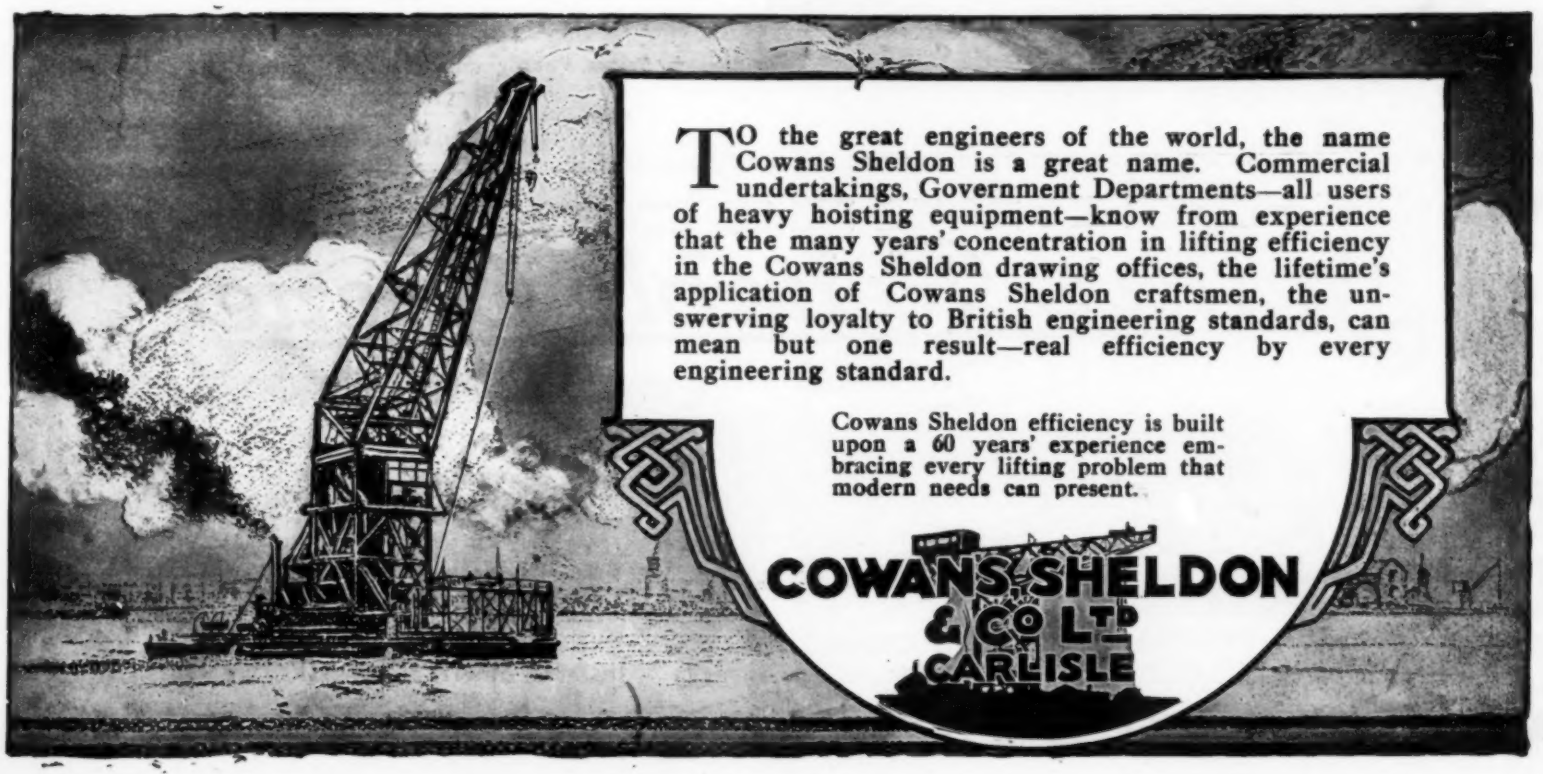

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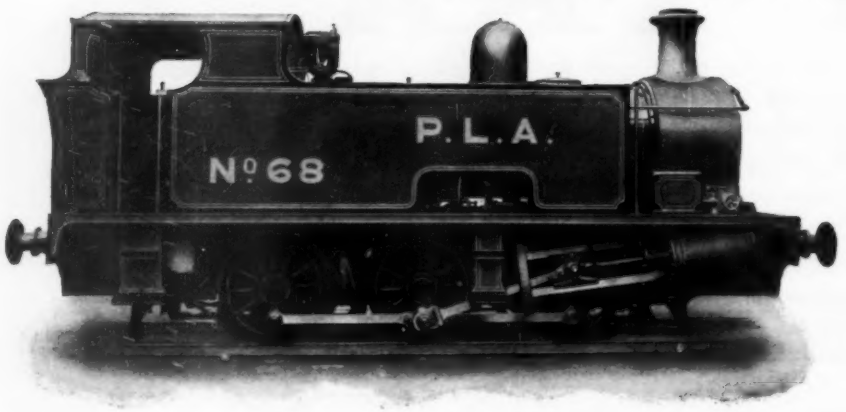

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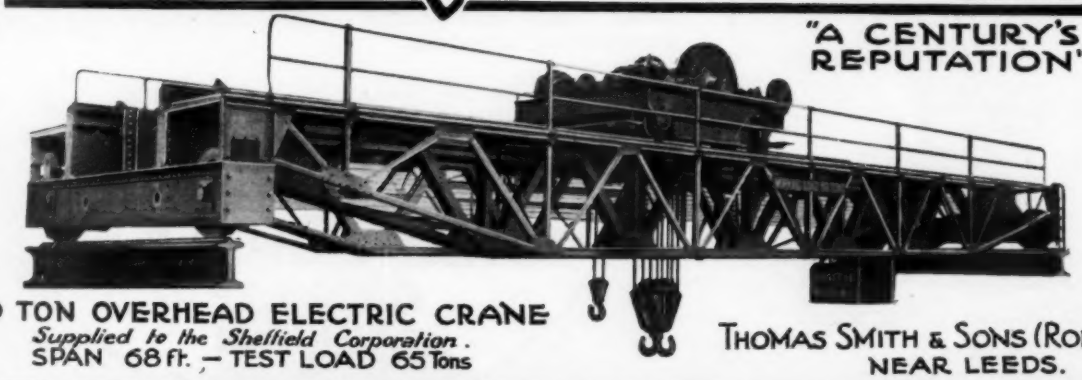

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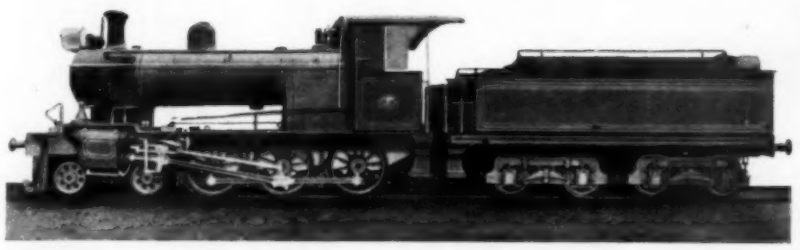

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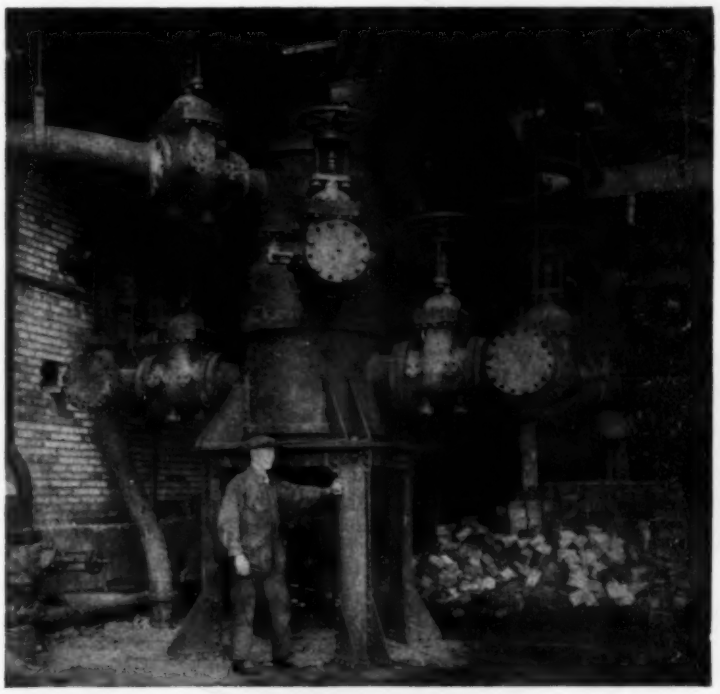

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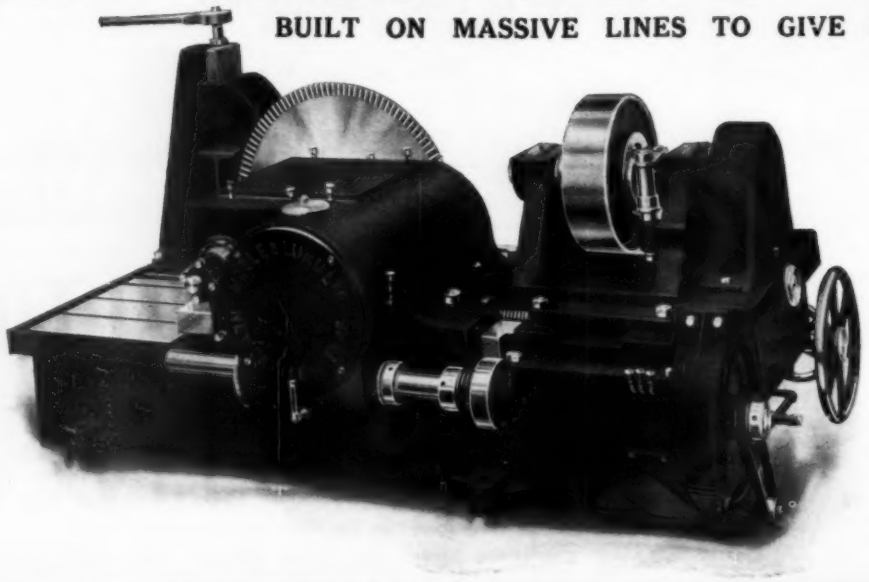

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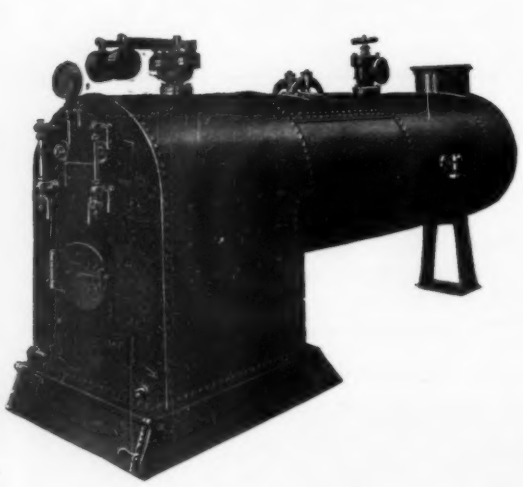

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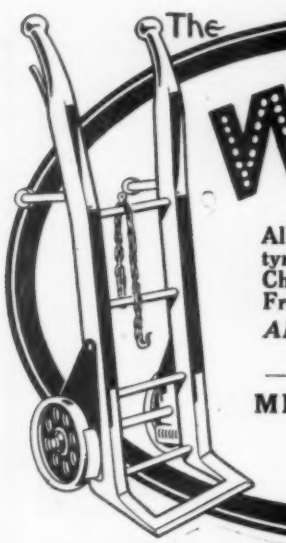

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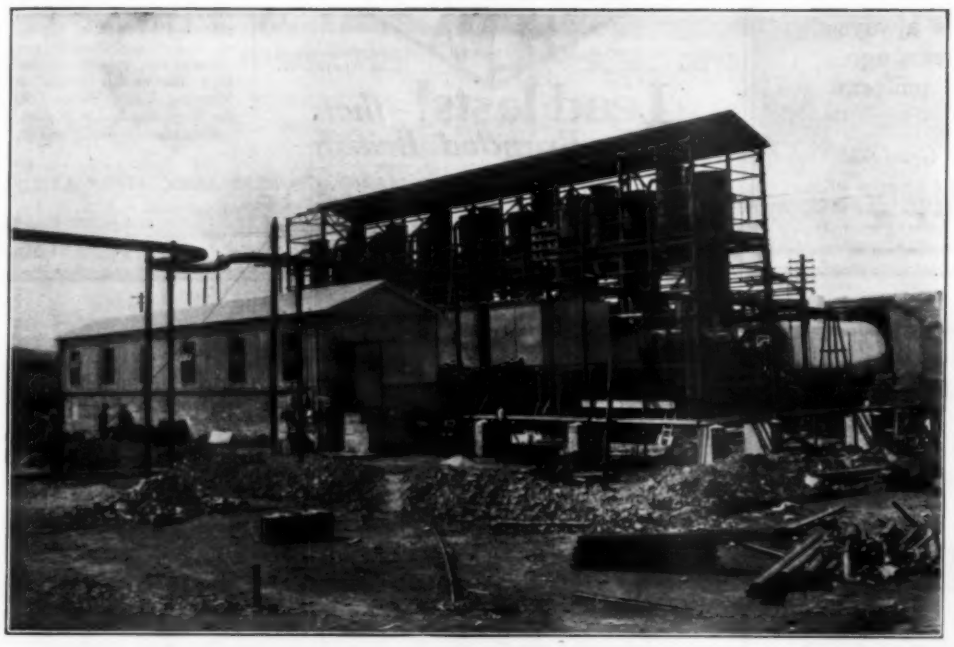

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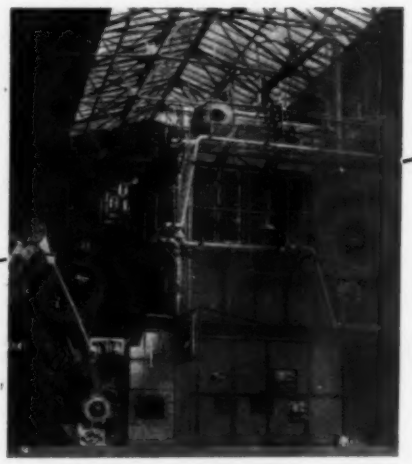

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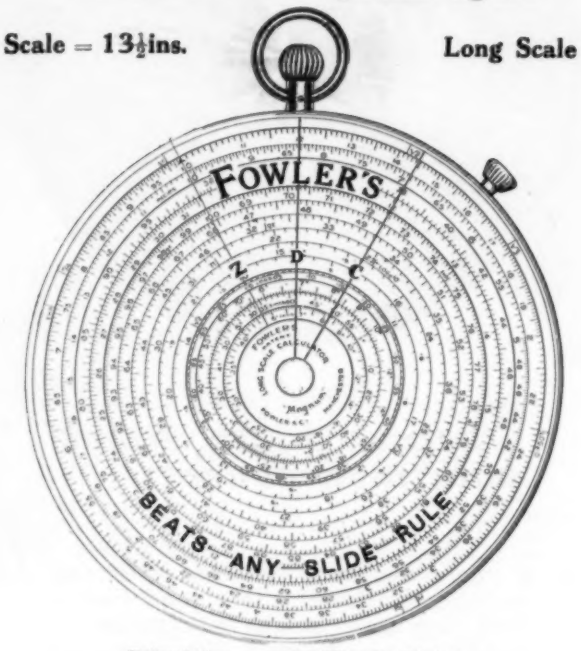

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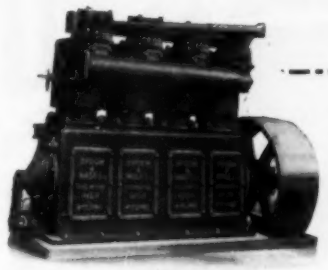

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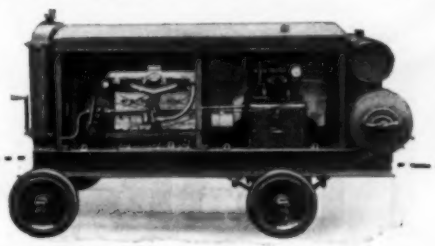

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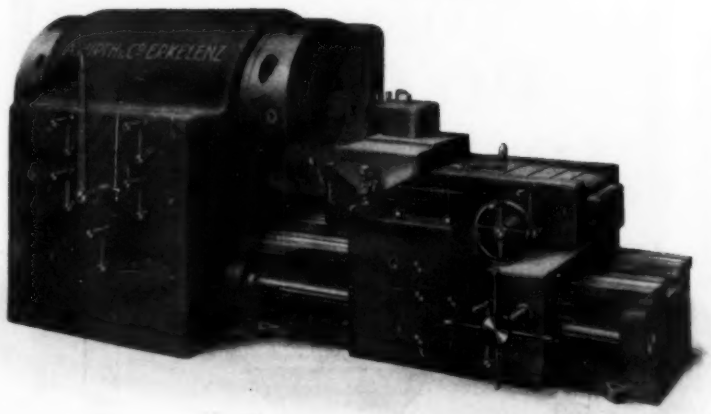

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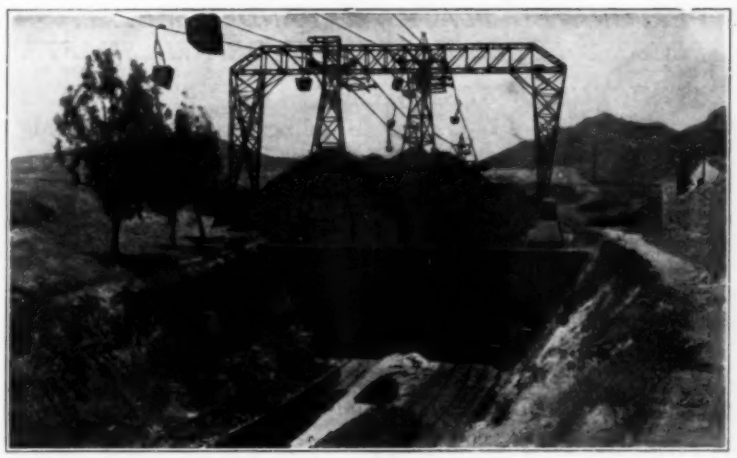

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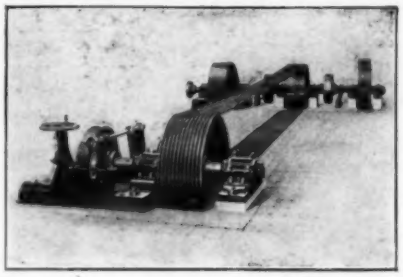

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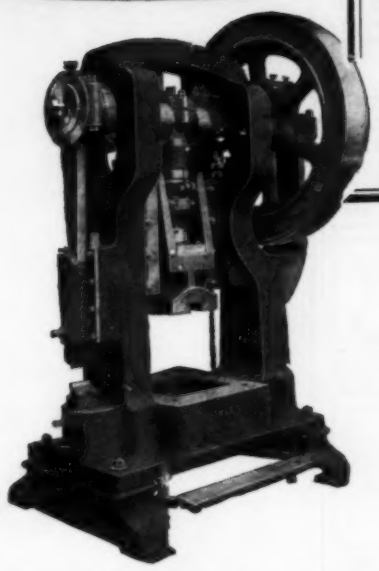

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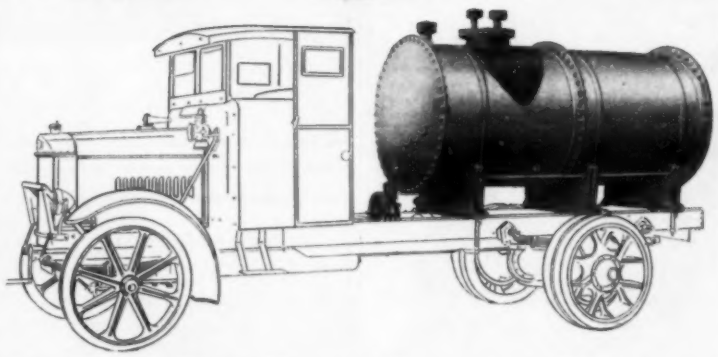

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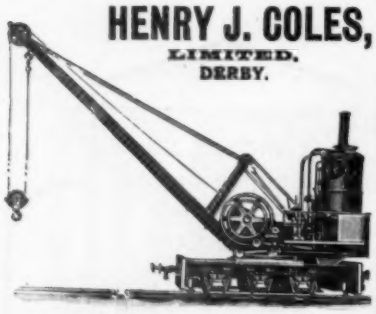

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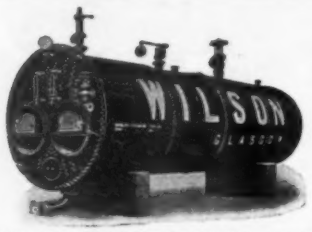

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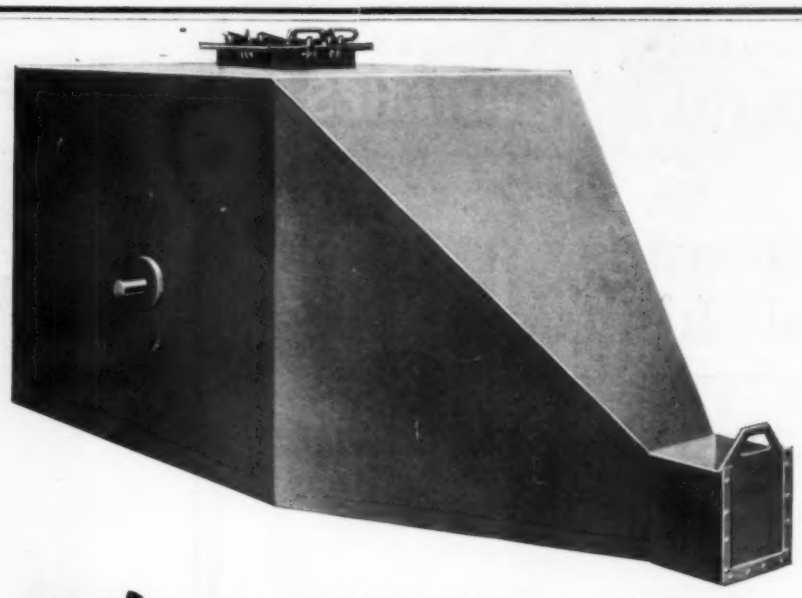

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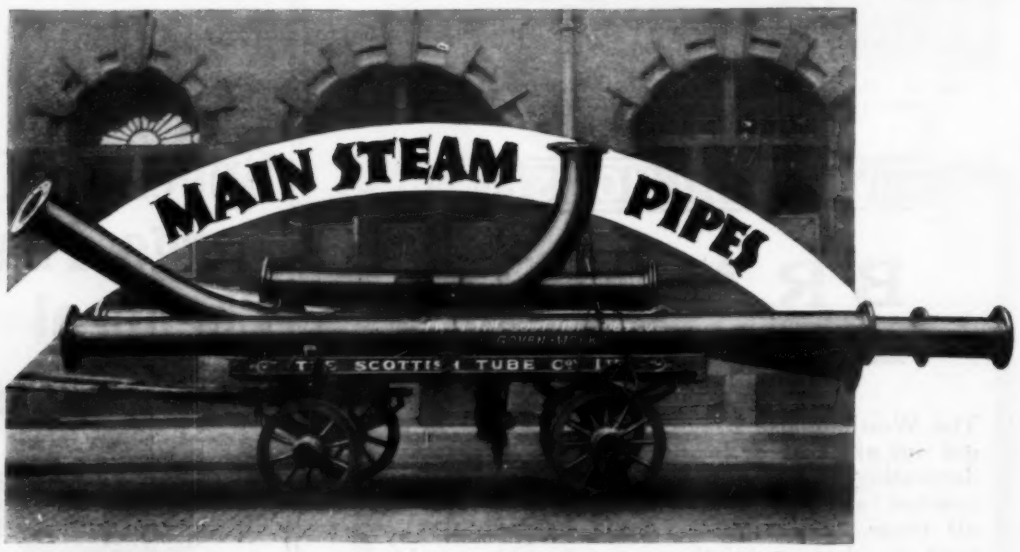

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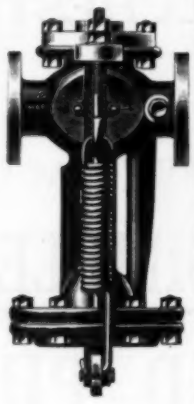

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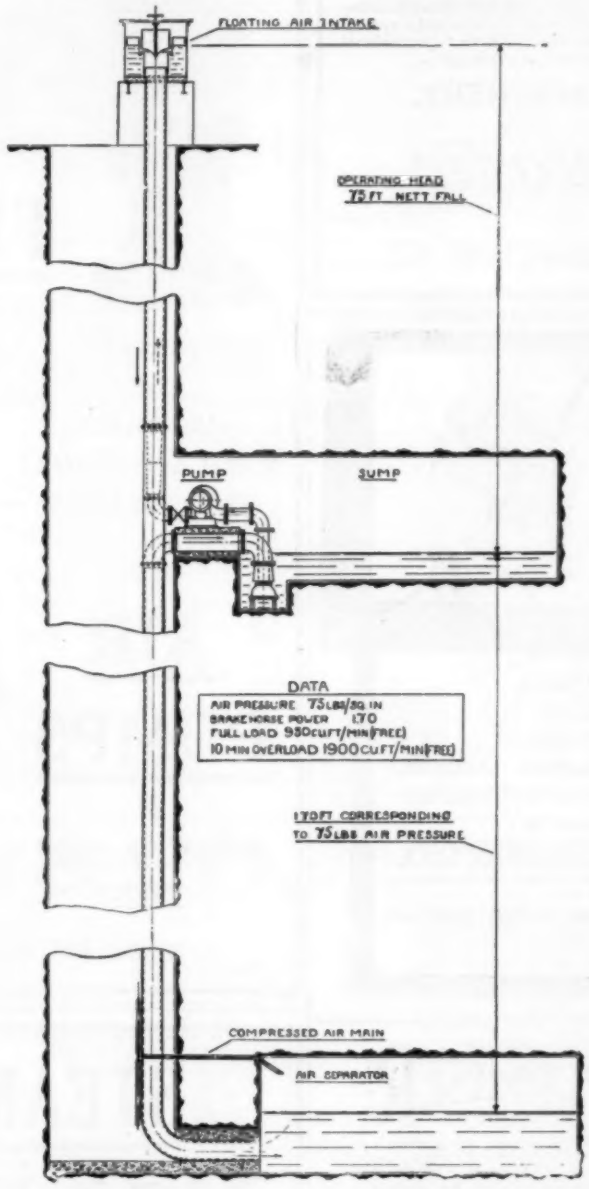

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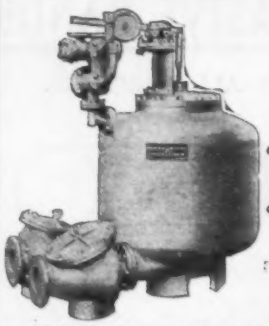

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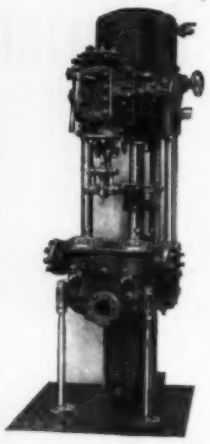

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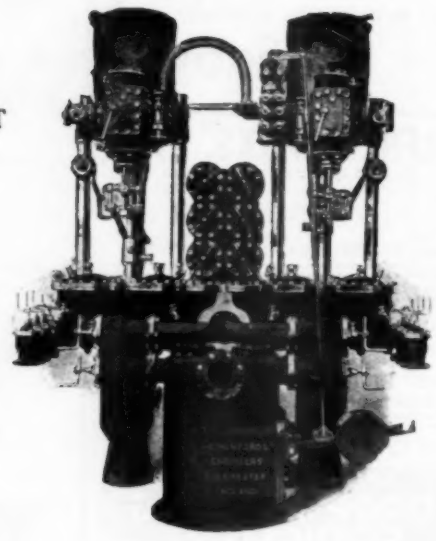

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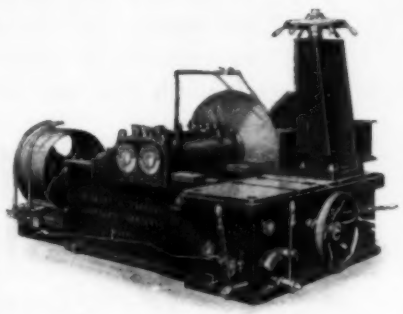

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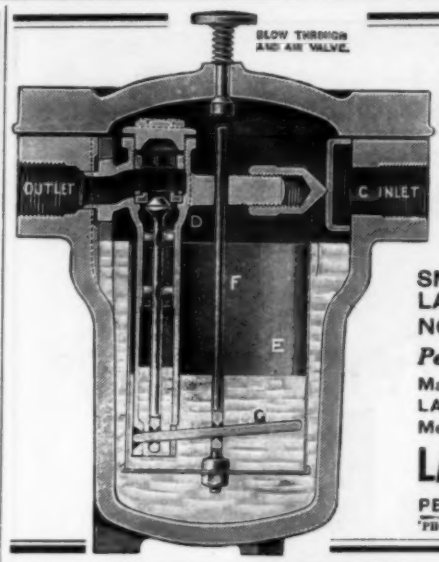

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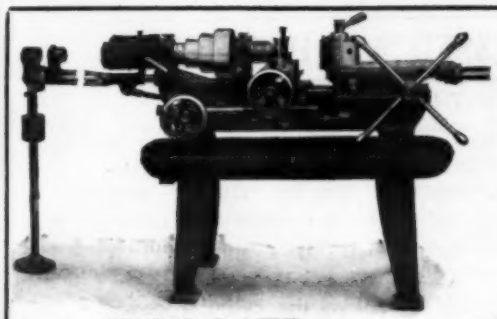

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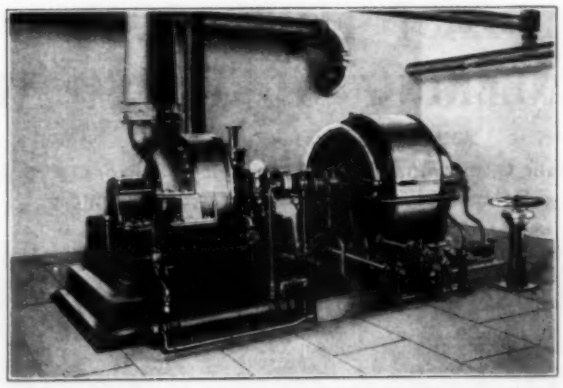

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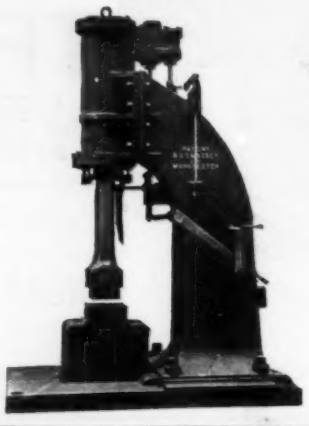

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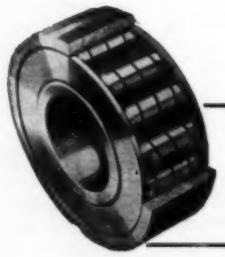

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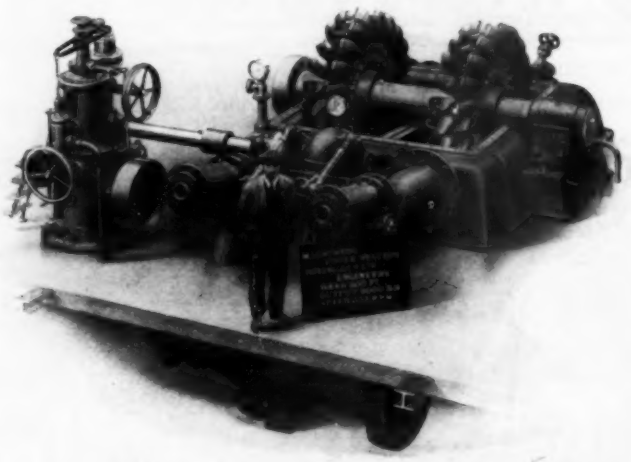

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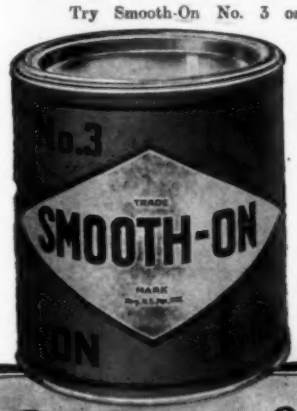

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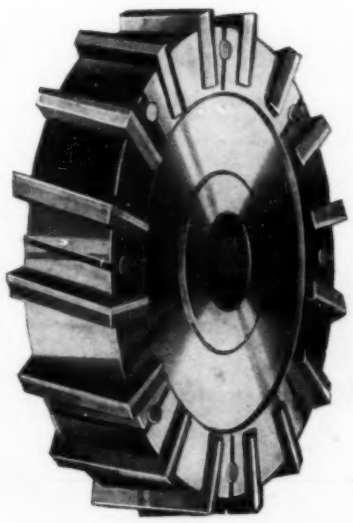

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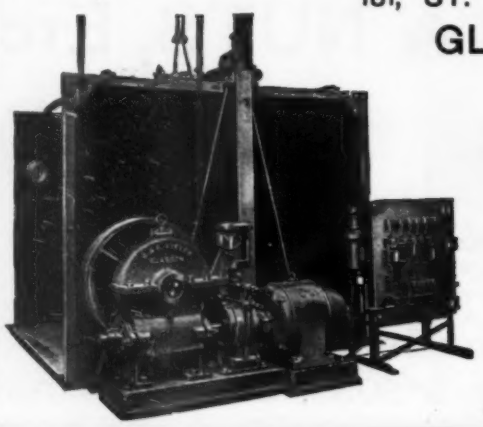

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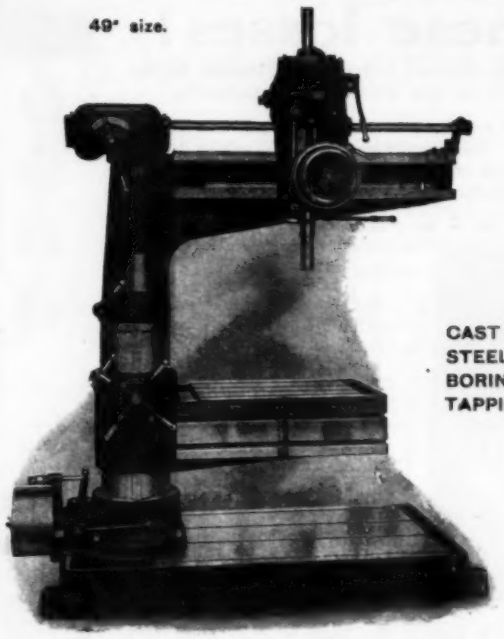

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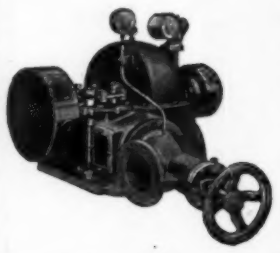

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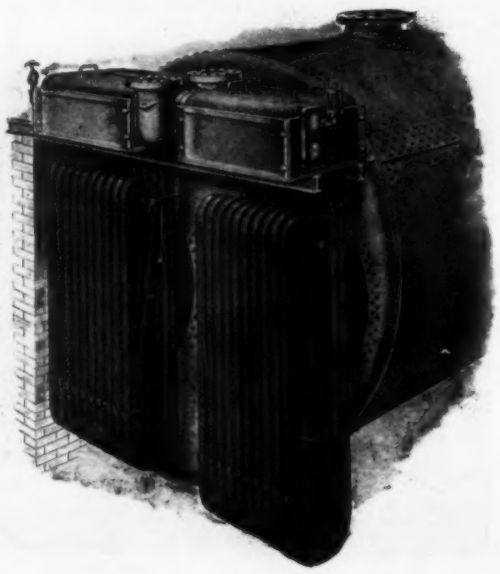

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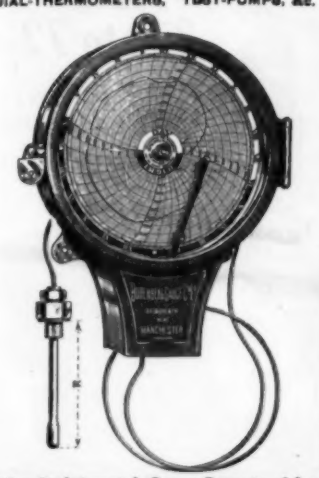

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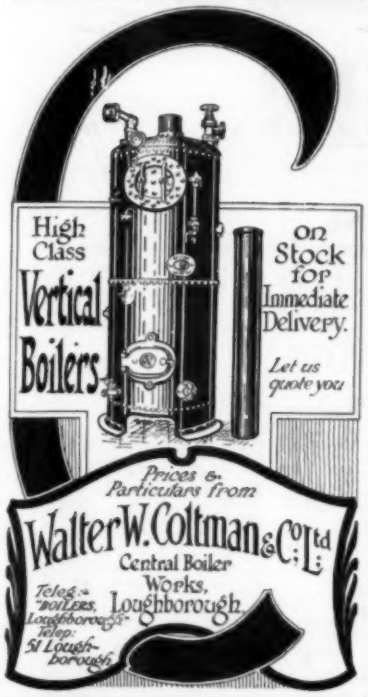

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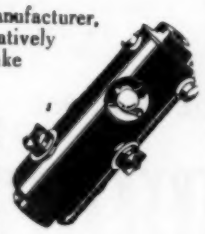

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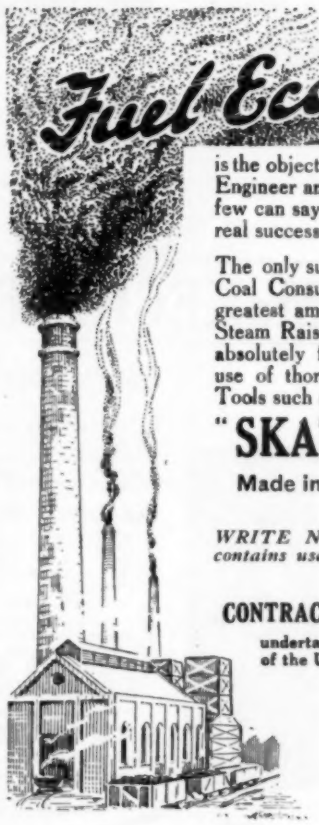

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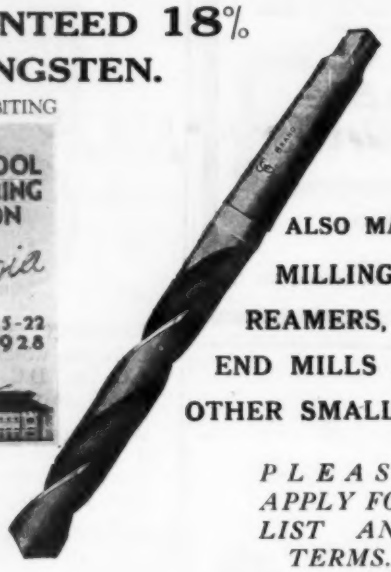

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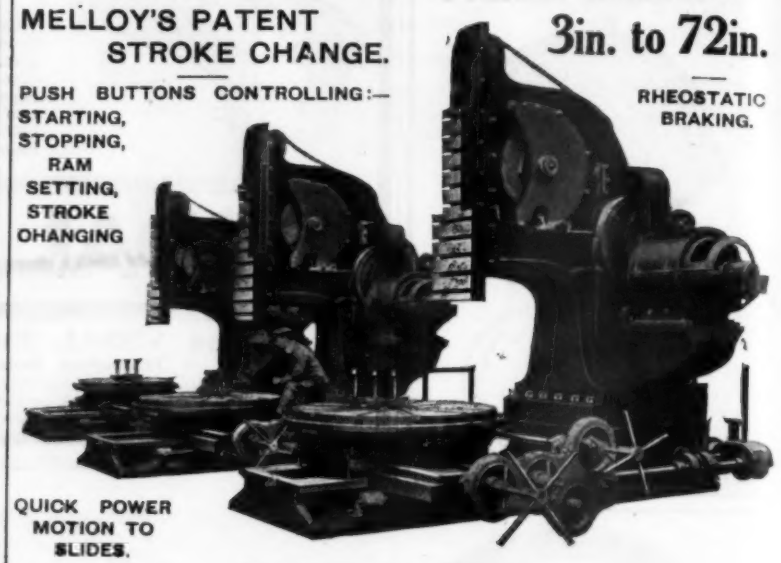

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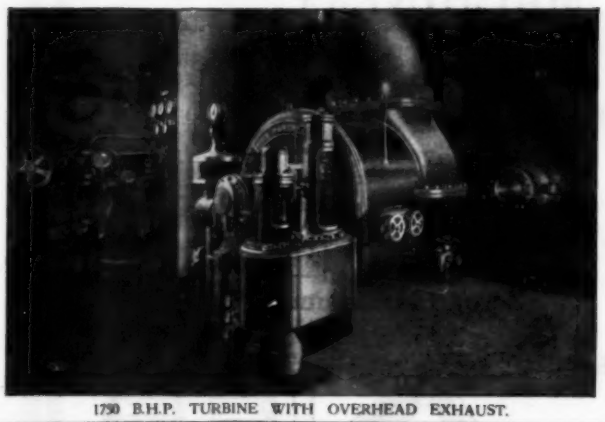

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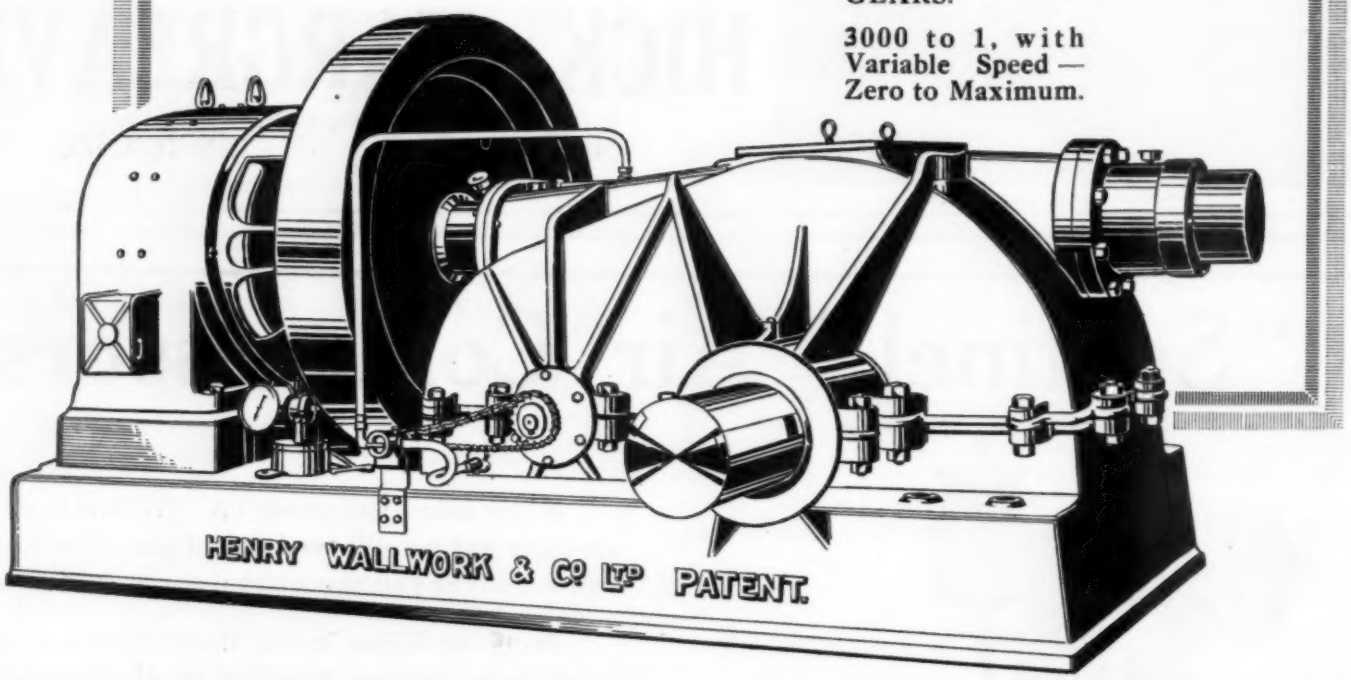

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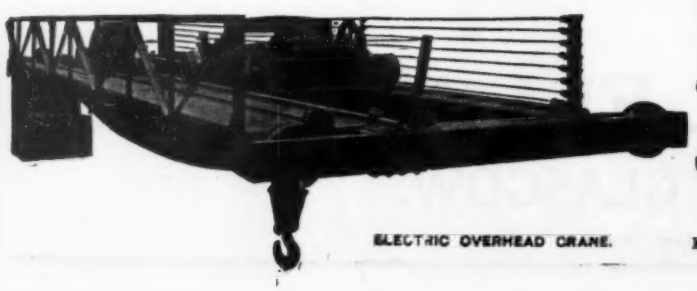

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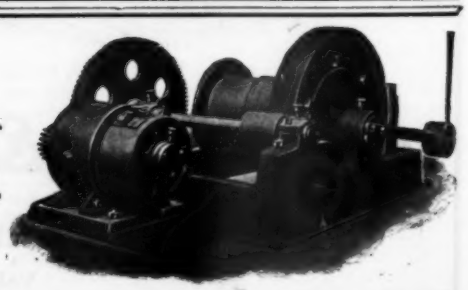

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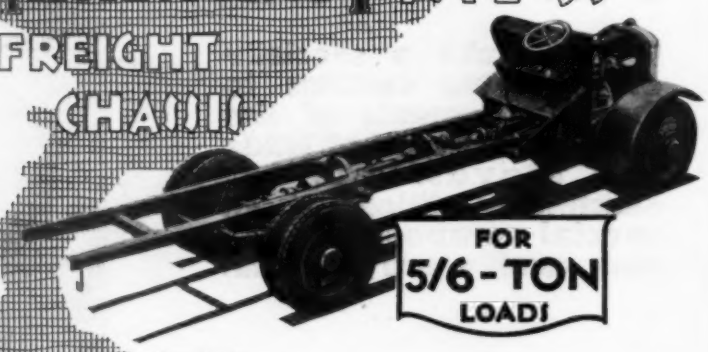

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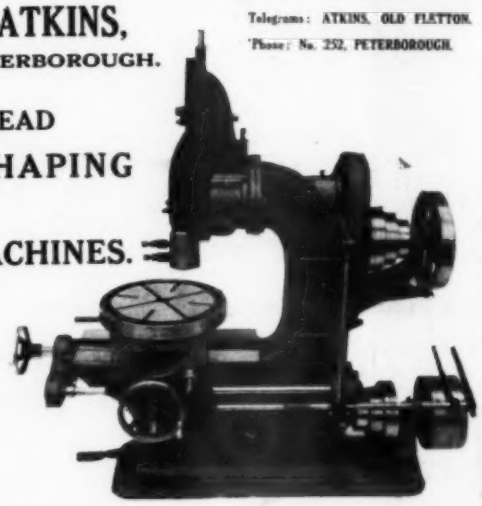

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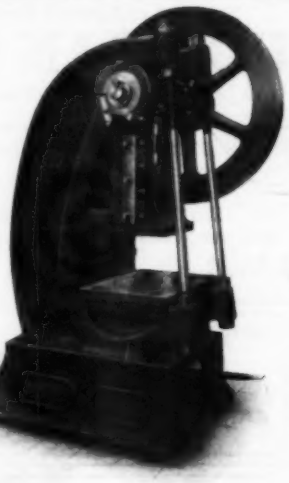

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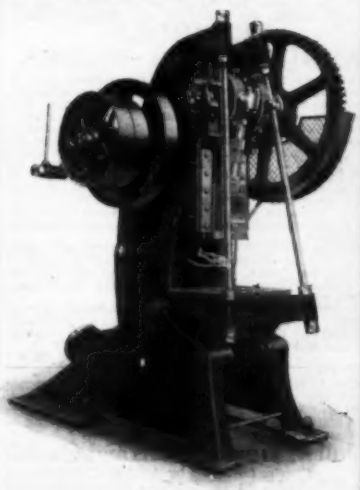

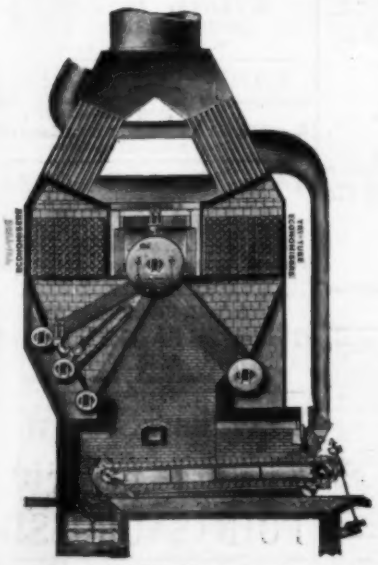

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